THE WEEK'S EVENTS

USHA Has Allocated All Available Money

$150,000,000 left cannot be allocated because of restrictions on annual subsidies

In announcing completion on Dec. 8 of loan contracts for twelve additional housing projects in seven states and earmarking of funds for 42 other communities, the U. S. Housing Authority practically exhausted its ability to approve further slum clearance projects under existing legislation.

Although Congress authorized USHA to make commitments up to $800,000,000, it is not possible to arrange loans for this full amount because Congress also limited the commitments for the annual subsidies which USHA makes in order to hold down rentals on the projects. When all present earmarkings are translated into loan contracts, the stipulated maximum of $28,000,000 in annual subsidies will be used up.

Existing contracts provide for the loan of $291,656,000 to 67 communities, while an additional $355,919,000 has been earmarked, bringing the total program to $647,575,000.

A new program

USHA Administrator Nathan Straus, announcing that he is "broke but happy", said that he has on hand unsatisfied applications for additional projects totalling about $200,000,000, and that he is informed additional projects being planned in the field, but not yet filed in Washington, approximate $300,000,000 more. While he carefully disclaimed any intention of asking Congress for a definite sum with which to continue the program, these figures indicate that a bill will be introduced to authorize at least another $500,000,000 program, and possibly more.

Summing up his initial program, Mr. Straus pointed to a number of definite accomplishments in the low-cost housing field, including: The organization of 221 local housing authorities where a year ago there were only 46, some inactive; perfecting a labor agreement stabilizing wage rates for the duration of a job and eliminating jurisdictional strikes; demonstrating that the 10 per cent local contribution requirement is workable and that tax exemption is an effective method of providing local contribution toward annual subsidies; and proving that the cost limitations of $1,000 and $1,250 per room written into the law can be met. The 58,500 dwelling units now under contract average only $752 per room, or about $3,100 per family. (These figures are on the same basis as cost figures on private construction issued by the Bureau of Labor Statistics.)

Wide World Photo

WORK BEGINS ON CIRCUMFERENTIAL PARKWAY

New York City officials inaugurated construction work on the city's new $28,000,000 circumferential parkway by laying the cornerstone for the three-level bridge which is to be built at the intersection of the new parkway with the Whitestone Parkway. The towers of the Whitestone bridge, now under construction, can be seen in the background.

The city's newest parkway, financed in part by a PWA grant, will circle the southeastern end of Long Island, passing through the boroughs of Queens and Brooklyn to connect with the Long Island parkway system.

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Canal Enlargement Study Urged in Report

The increasing size of ships, both merchant and naval, and an anticipated rise in traffic through the Panama Canal, makes it necessary to decide now whether to construct additional locks in the canal, General C. S. Ridley, governor of the Canal Zone, stated in his annual report to the Secretary of War, made public Dec. 11. The Corps of Engineers has been making a preliminary study of the problem under authority of a 1936 Congressional resolution.

Engineering Held Not a Service

Engineering and surveying firms cannot, in the opinion of the wage and hour administrator, claim exemption from the provisions of the federal wage and hour act under the clause which exempts employees of retail or service establishments the greater part of whose selling or servicing is in intrastate commerce.

The administrator, in an interpretive bulletin issued Dec. 7, said that he had received inquiries from a number of types of firms as to whether they fell under this clause. He said that they did not, and mentioned among others, engineering firms, firms engaged in making geological surveys, toll bridge companies, water supply companies, electric and gas utilities.

"Service establishments," the bulletin said, "are usually local in character and render a service to the ultimate consumer for direct consumption. The service is usually purchased in small quantities for private use rather than for industrial or business use."

Krug Defends TVA Charges

Says estimates showing agency will have a deficit are based on obsolete data

Speaking for Director David E. Lilienthal (who, it was revealed, is seriously ill and unable to testify) J. A. Krug, chief power planning engineer, this week completed a detailed defense of TVA power policies and rates before the congressional committee investigating that agency.

Taking issue with testimony to the effect that TVA's power revenues would be insufficient to return operating costs and fixed charges, Krug said that revenues from ultimate development of both the present three-dam system and the final ten or eleven-dam system will yield an ample margin over all costs. Detailed statements submitted to the committee showed annual surpluses of $1,923,000 in the former case and $4,625,000 in the latter.

Asked by the committee to comment on figures submitted earlier by E. L. Moreland, indicating a $10,000,000 annual deficit for the ultimate system, Krug pointed out that Moreland used early TVA data. These indicated installation of 1,700,000 kw. of capacity, whereas revised figures now indicate a total installation of 1,401,500 kw. will be sufficient. Total investment is set, therefore, at $510,083,000 by Moreland, but at only $479,565,000 by Krug. Of this, Moreland allocates $348,917,000 to power; Krug only $255,777,000. Annual power cost including interest and depreciation, transmission expense, taxes, development expense, and all other costs is given by Moreland as $34,488,000; by Krug as $19,344,000. Annual revenue from power is estimated by the two men, respectively, at $24,136,000 and $23,969,000.

Krug also defended the operations of the "yardstick" communities and associations distributing TVA power, stating that distribution costs are met with a substantial margin of safety. He denied that distributors are given free services by TVA.

In regard to the purchase of privately-owned power facilities, Krug noted that agreements had been reached with Tennessee Public Service, Kentucky-Tennessee Light & Power, Holston River Electric, and West Tennessee Power & Light. Negotiations with companies in the Commonwealth & Southern system, however, "made a different story," he said, commenting on Wendell L. Wilkie's plea for arbitration of the price to be paid for facilities desired by TVA and municipalities within its area.

Krug held that this method would be impossible because: The municipalities would refuse to be bound by a "blindfold" agreement. A settlement reached by arbitration would be subject to legal attack, thus leading to delay. Arbitration itself would entail a delay of a year or more. The TVA act prevents any agreement to draw a boundary beyond which TVA will not extend its facilities.

This announcement was immediately attacked by several officials of the Commonwealth & Southern system, who pointed out that arbitration is a method of settling disputes that has many times been recognized by the government and that if any legal bar exists it can readily be removed by Congress.

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Sixteen Dams Being Built By Reclamation Bureau

During the past year the Bureau of Reclamation has had sixteen dams under construction and work was in progress on 32 projects in 12 states, John C. Page, Commissioner of the Bureau of Reclamation, pointed out in his annual report to the Secretary of the Interior. The new dams were begun during the year, Vallecito Dam on the Pine River in Colorado and Deer Creek Dam on the Provo River in Utah.

Six dams were completed during the year, bringing to a total of 147 the number of storage diversion dams which have been completed since the origin of the bureau in 1902. Completed dams are: Taylor Park Dam on the Uncompahgre project in Colorado, Unity Dam on the Burnt River project in Oregon, Alamogordo Dam on the Carlsbad project in New Mexico, Anita Dam on the Huntley project in Montana, the Small Box Canyon Dam on the Rio Grande project, and the Cross Cut Dam on the upper Snake River project in Idaho.

Projects now under construction, Commissioner Page said, will eventually add about 2,500,000 acres to the cultivated area of the arid and semi-arid states in the west.

Gross revenue from the sale of power at the 24 plants operated on federal reclamation projects totaled $6,378,000, of which $1,888,000 was from the sale of Boulder Dam power. Revenues to the Reclamation Fund were increased during the year by passage of a bill providing that 52½ per cent of money collected up to June 30, 1938 on royalties from Naval petroleum reserves be deposited in the fund. Relief from payments due during the fiscal year was granted to ten different projects, postponed payments amounting to about 10 per cent of the total due.

Growth Reported By F.A.E.C.T.

Federation of technical men has membership over 7,500 at end of fourth year

A growth of membership from about 5,000 in October 1937 to 7,525 in November of this year was reported at the fourth annual convention of the Federation of Architects, Engineers, Chemists & Technicians, C.I.O., held in Washington, Dec. 9–11. Much of the growth is accounted for by affiliation of the Society of Designing Engineers, an organization of automotive designers with a membership of about 2,000, and of the Minnesota highway engineers organization. New chapters in addition to these have been established during the year in the Westinghouse plant in South Philadelphia and at the Philadelphia Navy Yard, in San Francisco, two in New York City, and one each in Milwaukee and Denver. Organization committees have been set up in other regions.

Student chapters

Efforts are being made to interest technical students in the FAECT, and to that end chapters, or organizations within the American Student Union, have been set up at California Tech., M.I.T., Harvard, Carnegie Tech., Swarthmore, Ohio State, N.Y.U., Cooper Union, Columbia, City College (New York), Brooklyn Poly., and Brooklyn Technical High School.

Numerous new contracts covering employment conditions were reported, chiefly in the industrial field.

The federation's monthly publication, *Technical America*, has proved to be a considerable liability and as a result it is to be published hereafter as a weekly supplement to *The CIO News*. Twice a year, however, *Technical America* will be published in magazine form.

Professional relations

Relations between unions and the professional societies in the architectural and engineering fields were discussed at an open meeting held Friday evening. Speakers were A. C. Shire, technical director, U. S. Housing Authority, Louis K. Justement, president, Washington Chapter, Amer. Inst. of Architects, V. T. Boughton, managing editor, *Engineering News-Record*, and Walter Polakov, engineering consultant, United Mine Workers.

Shire spoke of the activities of the federation in connection with federal housing. Difficulties which developed in meeting the federation's demands with respect to employment of apprentices were reviewed by Justement. In dis-

cussing the objectives of the federation, Justement said that if major attention is to be centered on pay and working conditions then the federation can expect to attract relatively few architects, but if it broaden its objectives it might reach many men in offices where collective bargaining is no issue. On the same subject Boughton stated that he did not expect to see many licensed engineers turn to unions for assistance in improving their economic status if the state and national professional societies live up to their possibilities, but that many subprofessional men might seek such help from a union provided the union's standards were high enough to attract the professionally minded man.

A new constitution was approved at the convention and the principal officers were reelected for another year: Lewis A. Berne, president, Marcel Scherer, vice president in charge of organization, and James A. Gaynor, secretary-treasurer. New vice-presidents elected are Stuart Green, St. Paul, and Jules Korchien, New York.

CONTRACTS AND CAPITAL

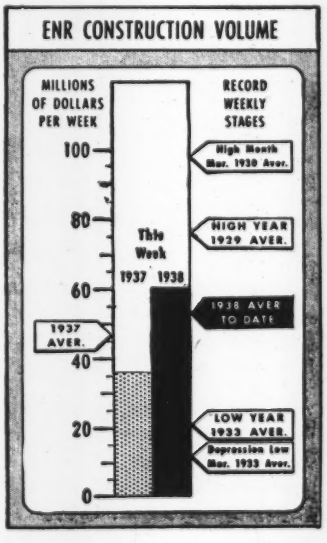
ENGINEERING construction awards for the week, $60,208,000, are 69 per cent above the corresponding 1937 week, but 7 per cent below last week.

Construction volume for the year to date, $2,645,824,000, is 12.7 per cent higher than the $2,347,849,000 reported for the 50-week period in 1937.

Private construction awards for the current week are 46 per cent higher than the week a year ago, and 10 per cent higher than last week. Public awards are 74 per cent above a year ago, but 10 per cent below the level of a week ago.

In the classified construction groups, bridges report the second highest weekly volume of the year. Two awards totalling $4,530,000, one each in New York and New Jersey, are responsible for the high volume. In addition to bridges, waterworks, sewerage, commercial building and large-scale housing, public buildings, earthwork and drainage, and highways report gains over the 1937 week, while waterworks, sewerage, commercial building and large-scale housing, and earthwork and drainage are above last week's figures.

New capital for construction purposes for the week totals $73,104,000, an increase of 174 per cent over the corresponding week last year. This week's financing includes $35,752,000 in state and municipal bonds, $26,602,000 in USHA loans to 8 municipalities, $8,611,000 in REA loans for rural electrification, $1,500,000 in RFC loans to private industry, and $639,000 in corporate security issues.



CONTRACTS

(Thousands of dollars)

	Week Ending Dec. 16 1937	Dec. 8 1938	Dec. 15 1938
Federal	$2,585	$7,912	$7,171
State & Municipal	26,008	47,451	42,664
Total public....	$28,593	$55,363	$49,835
Total private...	7,113	9,436	10,373
TOTALS	$35,706	$64,799	$60,208
Cumulative 1938 ..... (50 weeks)....			$2,645,824
1937 ..... (50 weeks)....			$2,347,849

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1937 50 Wk.	1938 50 Wk.
NON-FEDERAL	$1,414,203	$2,486,471
Corporate securities	513,630	372,848
State & Mun. bonds	492,508	719,252
PWA loans, grants	178,126	723,265†
RFC loans	29,939	101,844
U.S.H.A. loans....	.....	291,656
R.E.A. loans	.....	76,106
Federal Aid-highways	200,000	201,500
FEDERAL	$746,223	$1,143,695
TOTAL CAPITAL	$2,160,426	$3,630,166

†Adjusted for rescissions and amendments in PWA allotments.

FHA MORTGAGES

	Week Ending Dec. 11 1937	Dec. 3 1938	Dec. 10 1938
Selected for appraisal	$8,347	$19,322	$19,818*
Cumulative 1938 ..... (49 weeks)....			$959,221*
1937 ..... (49 weeks)....			$573,831

* Subject to revision.

ENR INDEX NUMBERS

Index Base		1913	1926
Construction Cost	Dec.....	234.89	112.87
Building Cost	Dec.....	196.07	105.99
Volume	Nov.....	199	87

Reclamation Job Urged For National Defense

Hawaiian project can carry only half its cost, Reclamation Bureau reports

Only half the cost of a proposed reclamation project on the Island of Molokai, Hawaii, would be charged to the water users, the rest of the $5,000,000 being charged to the defense of the island of Hawaii in emergencies or wartime, if the recommendations made in a Bureau of Reclamation report are accepted.

The report, made by Honolulu representatives of the Bureau of Reclamation with the aid of a $25,000 PWA allotment, proposes a $5,000,000 project to irrigate 12,000 acres utilizing 18 miles of tunnels with a capacity of 80 million gallons per day. The report estimates that water users could repay $2,750,000 and that "the project would have a value to the islands and the nation in emergencies and as a means of strengthening national defense equal to the remaining $2,250,000 of the cost."

Molokai is an island formed by now extinct volcanoes about 52 miles from Honolulu. The northern side is very steep but well watered, while the fertile and gently sloping southern side receives little water. The proposed project would consist of a system of tunnels along the northern cliffs with collecting basins in the bottom of the steep wet canyons. The collecting tunnel would extend to a point out of the range of the heavy rainfall, whence a canal would lead to irrigable land.

Eventually, the report states, Molokai could become a source of food to the Hawaiian Islands, which now import more than 63 per cent of all their food from the mainland, "thus lessening the hazard of the population, including the army and navy, being short of food during prolonged strikes or war blockades."

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Tupelo Reduces Rates

Announcing that its action was in reply to statements made last week by former chairman A. E. Morgan of the TVA that Tupelo, Miss. was losing money by its "yardstick" rate for TVA-produced power, the city introduced a 5 per cent cut in the price of industrial power and about an 11½ per cent cut on commercial power, both effective Feb. 1. Commercial rates will range from 2 cents to 8 mills per kilowatt-hour, depending on quantity purchased, and industrial charges will range from 8 to 2½ mills.

Modern Training Urged for C. E.'s

Middle Atlantic section of S.P.E.E. meets in New York City

Addressing a group meeting of the Middle Atlantic Section of the Society for the Promotion of Engineering Education at New York on Dec. 10, three engineers called for modernization of teaching procedure. The speakers were Irving V. A. Huie, new Commissioner of Public Works of New York City, Enoch R. Needles, consulting engineer, and F. E. Schmitt, editor of *Engineering News-Record*.

Huie first emphasized the fact that the technical college does not and should not be expected to turn out a finished civil engineer, and that since circumstances usually dictate the special field which the graduate will enter it is not desirable to attempt specialization in college. He stressed the importance of an apprenticeship system in engineering practice. New York City's Board of Transportation has already provided for a number of cadet engineers, similar to those of various industrial concerns. With respect to educational methods, Huie recommended that practicing engineers be engaged on part time to teach the chief technical branches in college.

Needles urged that numerous detailed technical courses of instruction be removed from the civil engineering curriculum in order to allow room for selected academic studies. Among the courses that should be discarded would be theory of reinforced concrete, fluid mechanics and laboratory, structural and sanitary design, building works organization and administration, heat power engineering, and the like. In their place he would include Biblical history, language, literature, psychology, philosophy, political science, history, and financial organization. Needles argued strongly for a six-year course, of which the last two years would be devoted to technical specialization. "With this six-year preparation", he said, "we may eventually produce a civil engineer who will not be greatly troubled about his social and economic status".

Schmitt asserted that civil engineering education in the past has produced excellent results, but saw a new demand for efficiency in the complexity of demands laid upon the civil engineer by present-day conditions. As an immediate possibility he proposed that certain wastes be eliminated from present courses and that auxiliary subjects necessary to a successful engineering career be added in their place. Looking ahead to adequate preparation of the next generation of engineers he suggested the possibility of a more fundamental rearrangement of college courses, based on recognition of the three fundamentally necessary departments of civil engineering training: tools and skills, basic technical and auxiliary sciences, and engineering procedure.

Discussion brought out specific examples showing that instruction in specialized engineering branches is not an important factor in the success of the graduate. F. H. Frankland, chief engineer of the American Institute of Steel Construction, charged the difficulties of civil engineering education to inadequate preparation in the primary and secondary schools. The influence of woman teachers, he said, is particularly injurious.

NEW PUBLIC WORKS OFFICIALS NAMED IN NEW YORK CITY

J. FRANK JOHNSON

IRVING V. A. HUIE

HOMER R. SEELY

Three of the top positions in New York City's Department of Public Works were filled on Dec. 12 when Mayor LaGuardia administered the oath of office to Irving V. A. Huie as commissioner, to J. Frank Johnson as chief engineer and to Homer R. Seely as deputy commissioner in charge of bridges. Other engineers in administrative positions in the department are Richard H. Gould in charge of sewage disposal and Edward J. McGrew, Jr., in charge of public buildings.

Huie, who has been acting commissioner since the resignaton of Major Gen. Edward M. Markham, was formerly deputy commissioner in charge of bridges and previous to that associated with Madigan-Hyland, consulting engineers, New York.

Johnson has seen long service with the city starting in the old department of plant and structures in 1904; his most recent position, from which he is promoted, was chief engineer of the division of bridges of the public works department.

Seely, a graduate of Cornell in 1919, was employed by the Bethlehem Steel Co. on detailing and erection work until 1923 when he went with the Delaware River Bridge Commission, working on the bridge at Philadelphia. Two years later he joined the staff of the Port of New York Authority and in 1929 became resident engineer during the construction of the George Washington Bridge. He was next resident engineer on the Triborough Bridge from 1934 until 1937, and since that time he has been on design work in the Port Authority's office.

Freeways Approved By Road Officials

American Association of State Highway Officials holds annual meeting in Dallas

Passage of state laws giving highway departments authority to build roads of the limited access type in suitable locations was urged in a resolution adopted by the American Association of State Highway Officials at its convention in Dallas Dec. 5–8. Highway departments should be able to acquire sufficient width of right-of-way to protect the public investment in the highway and should have authority to enforce regulations controlling the use of private property abutting on state highways, the resolution held.

The association urged that state departments continue to assemble the facts now being compiled by the highway planning survey in order to make essential current revisions. Much of the value of the data compiled by the survey will be destroyed unless provision is made for constant revision to reflect changing conditions, it was held.

Elimination of bottlenecks in regional areas adjacent to metropolitan centers must begin soon, another resolution pointed out. It was recommended that legislation be adopted permitting amortization of land acquisition costs over a long period of years through rental or resale of land condemned adjacent to the right-of-way.

Other resolutions urged continuation of federal appropriations for highway construction as well as of the policy of making federal authorizations for highway construction in advance of actual appropriation. A study of the highway system from the viewpoint of national defense was recommended, as was adoption by the states of the revised model code of motor vehicle laws and the model municipal traffic ordinance. Diversion of highway taxes to purposes other than highways was protested.

Superhighways

Road construction was termed a vital part of any plan of national defense by Senator Tom Connally. The Senator's statements were echoed by Representative Wilbur Cartwright, chairman of the House Roads Committee. Cartwright referred to the report of the federal Bureau of Public Roads on superhighways which is now being compiled for presentation to Congress next year. He predicted a swing toward lower appropriations for highways at the next session of Congress.

Charles H. Purcell, retiring president of the association, attributed the reduction in federal highway appropriations to failure of certain states to obligate their funds rapidly enough.

McDONALD presents Bartlett award to F. R. White, (*right*)

Discussing the relationship between the highway contractor and the highway engineer, M. W. Watson, chairman of the highway division of the Associated General Contractors, urged payment in the public interest of an adequate salary to highway engineers. He recommended that plans be definite and clear-cut and that the clause providing that work be performed "to the satisfaction of the engineer" be omitted from specifications.

European roads and highways in the United States were compared by T. H. McDonald, chief of the federal bureau of Public Roads. McDonald emphasized that lessons could be learned by American road builders from the experience of European engineers. Pointing out the necessity for sound planning of the American highway system, he said, "The turning point has been reached very definitely in many states, necessitating sound new programs reaching far into the future."

Sidney J. Williams, director of public safety for the National Safety Council, directed the attention of the delegates to the need for speed zoning, with speed limits fixed in relation to the nature of the highway and the traffic.

The George S. Bartlett Memorial Award for outstanding service in the highway field was presented to Fred R. White, chief engineer of the Iowa highways by T. H. McDonald.

W. W. Mack of Delaware, retiring treasurer of the association was elected president for 1938-39. New vice-presidents are: H. E. Sargent of Vermont, W. W. Zass of Arkansas, M. R. Keefe of Indiana, and H. S. Reed of Arizona. J. V. Keily of Rhode Island was elected treasurer, and H. G. Shirley of Virginia and J. T. Ellison of Minnesota, were elected to the executive committee.

Incoming Official Attacks Outlay

Massachusetts governor-elect opposes further emergency authorizations by governor

Authorization by Governor Hurley of Massachusetts and his executive council of additional outlays of $4,700,000 to repair damage resulting from the recent hurricane and flood has been vigorously attacked by Governor-elect Saltonstall. Saltonstall last week issued a statement warning contractors obtaining contracts under the new authorization that he believes the action illegal and that when he assumes office he will not without thorough study recommend appropriations to meet the authorized expenditures.

In addition, the Massachusetts Federation of Taxpayers Associations has protested to the state attorney-general, claiming that the authorization is illegal.

After the Sept. 21 storm, contracts were placed for emergency work on highways, bridges, rivers, and public buildings, with the expectation that the expenditures would be covered by an appropriation at a special session of the legislature. When the legislature met in October it appropriated $19,500,000 for the purpose.

The state department of public works and various institutional departments have been responsible for most of the reconstruction work. It is understood that many of the contracts for the institutional work have been awarded on a cost-plus basis and that public works contracts have largely been based upon cost estimates by the state engineers.

Public hearings are scheduled before the attorney-general on charges that parts of the appropriation have been expended, especially in the state institutions, for work which did not result from the storm emergency.

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Bonneville Power Plans Changed by Elections

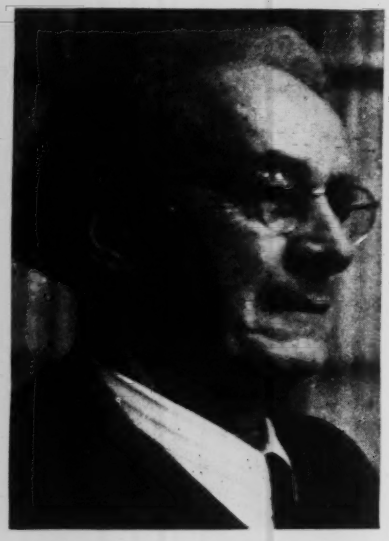
Because voters in seven counties in the state of Washington and one in Oregon rejected proposals at recent elections to set up public utility districts, the Bonneville administrator is reallocating about $1,250,000 worth of proposed transmission lines and substations. Administrator J. D. Ross stated that funds earmarked for the eight counties would be diverted to sections which did vote for public power.

Public utility districts were approved at the recent elections by seven counties in Washington.

Joseph Newell Dies Railway Consultant

Other deaths include Byrne, New York bridge designer, Lyman, former Mass. works commissioner

Joseph P. Newell, Portland consulting engineer specializing in railway matters, died there Dec. 5 at the age of 72. A graduate of Massachusetts Institute of Technology, Newell first worked for the Cincinnati Southern Railway as



JOSEPH P. NEWELL

a draftsman in 1888, but within a year he entered the employ of the Oregon Railway & Navigation Co., now part of the Union Pacific system. With that line for eight years, he rose to the rank of division engineer in charge of maintenance of way on the Oregon division, and in 1907 he began a consulting practice in Portland.

EDWARD A. BYRNE, former chief engineer of the New York City department of plant and structures and first chief engineer of the Triborough Bridge Authority, died in Rye, N. Y. Dec. 6 at the age of 74. Born in New York and educated at the College of the City of New York, he entered the city service two years after his graduation in 1884. In 1912 he became chief engineer of the department of bridges and became chief engineer of the department of plant and structures in 1916, a post which he held until 1933. In the latter year he became chief engineer of the Triborough Bridge Authority but was dismissed a year later when the State Civil Service Commission refused to make the post exempt.

FRANK E. LYMAN, former commissioner of the Massachusetts department

EDWARD A. BYRNE

of public works, died in Northampton, Mass. Dec. 12 at the age of 72. Lyman was a member of the commission from 1922 to 1936 and in recent years had served as coordinator for highway work in western counties.

WILLIAM J. CHALMERS, retired chairman of the Allis-Chalmers Co., died Dec. 11 in Milwaukee at the age of 86.

GEORGE A. STANNARD, a civil engineer with the U. S. Engineers on the Missouri River improvement project for the past ten years, died in Kansas City, Kansas, Oct. 31 at the age of 48. Stannard was formerly engaged in city planning at Lawrence, Kansas.

DAVID W. HARVEY, general manager of the Toronto Transportation Commission which operates Toronto's municipally owned street railway and bus system, died there Dec. 6 at the age of 51. Harvey graduated from the University of Toronto in civil engineering and gained his first engineering experience with the Ontario Power Co. He entered the Toronto city service in 1911 and has served the city since that time.

JOSEPH P. BAIN, 72, a retired civil engineer formerly on the staff of the Cleveland Railway Co., died Dec. 3 in Lakewood, Ohio. Before going with the railway company in 1916, Bain had served for more than 30 years with the City of Cleveland, leaving with the rank of assistant city engineer.

EDWIN P. ARNESON, 50, San Antonio consulting civil engineer, died there Dec. 7. A graduate of Texas Agricultural and Mechanical College in 1910, Arneson entered private practice in 1916 as a member of the firm of Walter & Arneson, with offices in San Antonio.

Ohio State Auditor Warns Contractor

Official says he will not pay bills on hot mix contracts to be let this month

Ohio state auditor Ferguson announced Dec. 9 that he will refuse to pay the bills on a $3,886,000 highway construction program for which bids will be received Dec. 27, a few days before the present state administration goes out of office.

Ferguson's position is based on the fact that about half the money to be spent would be for the hot-mix type of road construction which has been the subject of a senatorial investigation and the basis for a number of court suits during the past year. The investigation and the suits resulted from charges that the state had been paying exorbitant prices for this type of road material.

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Water Plant Workers Strike in St. Louis

Major pumping stations of the St. Louis city waterworks were shut down Dec. 12 by a strike involving jurisdiction over oilers in the pumping plant. A number of oilers employed by the water department recently dropped out of the Stationary Firemen Oilers and Coal Passers Union and joined the Operating Engineers Union, both AFL. At the request of the president of the oilers union (*ENR*, Nov. 17, 1938, p. 604), the city suspended the men.

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FPC Urges Penstocks On New England Dams

The Federal Power Commission has transmitted to the Secretary of War recommendations for the installation of penstocks at four of the flood control reservoirs soon to be built in New England. These are located at Franklin Falls, N. H., in the Merrimack River basin and at Knightville, Mass., Surrey Mountain, N. H., and Union Village, Vt., in the Connecticut basin.

This action of the FPC is the first application of the provision in the 1938 flood control act which directs that penstocks and other facilities adapted to possible future use for the development of hydro-electric power be installed in any dam authorized in the act upon the recommendation of the Chief of Engineers and the FPC.

The present recommendation has been referred to the Chief of Engineers for consideration.

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Arbiter or Advocate?

Sir: The question whether the engineer is an arbiter or an advocate is very important and should be thoroughly discussed in the hope of clarifying the matter. Your editorial of November 24, however, appears to ignore some of the realities. The old concept of the engineer as an impartial arbiter between the owner and the contractor may still be workable when the owner is an individual, aggressive in protecting his interests. However, when cities, states, and other public bodies enter into construction contracts their interests are likely to suffer in a dispute unless some one is definitely charged with the responsibility of seeing that every fact or circumstance favorable to the public body is investigated.

In the present organization of public works construction, this is one of the functions of the owner's engineer. There is no doubt that this responsibility for developing the arguments for one side of the case makes it more difficult for the engineer to be impartial in reaching a conclusion. For years past this has given a hollow ring to those old contract provisions which implied that the engineer is a judge sitting in majesty above the contending owner and contractor.

From another point of view, the ends of justice alone indicate that the engineer should err, if at all, in favor of the public body which employs him. In the determination of the cost of extras, for example, "a hair perhaps divides the false and true" and it is too much to expect that the engineer will be infallible. If he has erred to the disadvantage of the contractor the contractor is then free to protest or to go to law. If, on the other hand, the engineer has erred to the disadvantage of the public body that employs him, the matter is settled and the injustice is done.

Being free from selfish interest, most engineers in public work will readily allow any claim of the contractor which they think is so just that it cannot be questioned. Even claims that are likely to be questioned they will allow if they think their decision can be well defended. Since many public contracts now contain provision for arbitration and in view of the other resources the contractor has in case it proves the engineer has erred to the contractor's disadvantage, a conscientious engineer will, in doubtful matters, lean in the direction of his employer's interest. This, of course, makes him less satisfactory as an impartial arbiter, but under the present system of public works engineering there appears to be no other solution.

ARTHUR B. MORRILL
Detroit, Mich.

Public Relations

Sir: I certainly feel that the initial effort which was made in the McGraw-Hill publications on the general program of public relations is a very fine start. I hope it will keep up and that when you get through with the job we will have some information that will be of value to all business concerns—J. E. O'LEARY, *general sales manager, Pittsburgh-Des Moines Steel Co.*

Sir: May I express my appreciation for the campaign of education you have started on public relations for the contracting industry. I have spent a good part of my active years in an effort to help toward a better understanding of what the industry really is, the proper attitude of the public toward it and its proper attitude toward the public, both of them crying fields for missionary work.

I congratulate you on your interesting program—ARTHUR S. BENT, *president, Bent Brothers, Inc., Los Angeles, Calif.*

Sir: We wish to compliment you on the insert "Public Relations for Industry with Special Reference to the Construction Industry" which appeared in your October 7 issue, and which contains very good material.—S. H. EIGEL, *manager, Milwaukee Chapter, A.G.C.*

Sir: I think your organization has done a wonderful and worthwhile job in the insert "Public Relations for Industry, with Special Reference to the Construction Industry." I am sure that it will rebound to the benefit of the construction industry, and I hope that you may be able to keep up the good work. We will lend any assistance possible.—J. A. HIGGINS, *manager, Allied Construction Industries of Cincinnati.*

Sir: I have read the pamphlet "Public Relations for Industry" and find it contains food for thought for all employers.—OSCAR B. COBLENTZ, *president, McLean Contracting Co., Baltimore, Md.*

Texas WPA Contracts

Sir: In the news item and editorial comment on the WPA contract jobs and arrangements worked out in Texas, published in your issue of Nov. 24, through an oversight, I am sure, you gave the Associated General Contractors all credit for working out the plan with the Works Progress Administration. As a matter of fact, the arrangements were between the Texas state highway department, also various other governmental sponsoring agencies, and the WPA. The contractors are cooperating by backing the plan and bidding on the work.

CHAS. H. NEWELL
Manager, Texas Highway Branch, A. G. C.
Austin, Tex., Nov. 29, 1938

Low Heat Cement

Sir: I have read with much interest the paper titled: "The Field for Low Heat Cement" by H. S. Meissner and W. T. Moran of the Bureau of Reclamation, Denver, Colorado, published in the Nov. 10 issue of *ENR*.

It is unfortunate for your readers and the general public that the authors did not include in their story the results of research and field experience on portland-puzzolan cements of which some 1,500,000 barrels have been used on the West Coast.

Portland-puzzolan cements have had very thorough survey by the Bureau of Reclamation and if the record as given in Mr. J. L. Savage's paper "Special Cements for Mass Concrete," to which reference is made in the article, is criterion, portland-puzzolan cement is a low-heat cement and should be in any discussion.

CHAS. L. KIRK
Vice President
Eddystone Portland Puzzolan Cement Co.

ENGINEERING NEWS-RECORD

Copyright 1938, by McGraw-Hill Publishing Company, Inc.
Volume 121, Number 24

Editor, F. E. SCHMITT • *Editorial Staff*, V. T. BOUGHTON
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Editorial Offices at 330 West 42nd Street, New York

DECEMBER 15 1938

INTRODUCED only a few years ago, the detachable bit has become an accepted rock drilling accessory in the construction field. A survey just completed by this journal reveals that two-thirds of the firms doing rock drilling use the bits exclusively, 11 per cent stick to forged drill steel, the rest use both. The trends indicate that the detachable bit may in time displace its predecessor almost completely. However, more startling than its trend data, the survey shows that few contractors know their drilling costs or keep separate cost records of the various features of rock excavation. Only in rare instances was a contractor able to present comparable cost data on forged and detachable bits. The user obviously cannot determine with certainty which type of tool is best unless he knows relative costs. It seems folly to neglect costs on so important a construction item as rock drilling.

Capitalizing on Experience

PARKWAYS in the New York City metropolitan are now total 100 miles in aggregate length, and various sections of the system represent all degrees of efficiency. Those built ten years ago for example are in some respects obsolete, and even those built last year lack improvements provided on the more recently constructed. In effect the parkway system has been a huge research laboratory. The latest conclusions from this research are embodied in the Northern-Wantagh Parkway opened this week on Long Island and forming the final link in a 43-mi. express road from the Triborough Bridge to Jones Beach. They are conclusions almost solely concerned with one objective—highway safety—and it is for this reason that this obscure ten-mile stretch of parkway is significant. Its design includes every device and detail that experience has shown to be effective. Included among them are grade-separated crossings, divided lanes, cross-arm lighting standards, dark colored pavement, accelerating and decelerating lanes at entrances and exits, funnel entrances, sloping curbs, and wide, level shoulders. These details have been used before, extensively or in trial installations; they are all brought together for the first time in the Northern-Wantagh Parkway. The operation of this parkway is to be studied closely to test these safety devices further. It is by thus capitalizing on experience that engineers have brought the modern highway to its present state of excellence.

Basic Doctrine

AN IMPORTANT POINT was emphasized last week by a TVA witness before the Congressional inquiry committee in discussing the sore question of competition with existing utility companies. He said in effect that the consumer is entitled to have the benefit of the prices that the low-cost producer can make. This view is certain to find general acceptance as basic doctrine. It implies, of course, that low cost must be true cost and not an arbitrary figure. This also is basic doctrine, as reflected in law as well as in codes of business honesty. It is on this very point that Arthur E. Morgan in his recent testimony before the committee challenged the TVA's power dealings, asserting that the published rates disregard cost and that published cost figures are untrue. Unless the committee digs deeply enough into the facts to determine the truth about this assertion it will not contribute to clearing up a situation that represents one of the major business scandals of the day.

A Temporary Condition

EXCEPTIONAL CONDITIONS prevail at the moment in respect to municipal and state credit. Current bond issues are being sold at interest rates of 2 per cent, reflecting unprecedentedly high credit. Municipals are tax-exempt, of course, and the current supply is small compared with the demand. But the favorable present rates may also be due to the low earning power of other investment, that is, to the scarcity of industrial and business profits, since money tends to gravitate toward the fields of highest return. Abolition of tax exemption is under discussion, the supply of new municipal issues will increase, and investment earnings are certain to rise as the volume of industrial production increases. The present condition may therefore be expected to change, and cities may find borrowing to cost substantially more. For the moment it is their day in the investment market.

Land Fill Practice

RAISING a number of questions concerning the application of the land fill method of refuse disposal, which has been under trial in New York City this past year, comments by Harrison P. Eddy re-emphasize the need for research. Experience with refuse burial elsewhere focuses attention on those matters which logically would be among the first to be considered in a research program. Certain elements of practice, such as compaction, cover depths and odor control, have been under field

scrutiny on the New York fills, of course, but much more detailed information is needed. It is gratifying to report, therefore, that steps have been taken by the New York Department of Sanitation toward the inauguration of basic field and laboratory studies. When and if these investigations are made we will have a more definite appraisal of this method of disposal. It is not implied here that land fills are a substitute for incineration, but they might well serve as a desirable supplementary disposal facility; and where incinerators are not in use, the controlled fill is certainly a vast improvement over the noisome refuse dump. The large-scale demonstration fills in New York offer an opportunity to collect essential data on a subject which deserves thorough exploration.

Power and Prosperity

CURRENT HAPPENINGS bring national power policies again into the spotlight. Testimony at the TVA hearings and PWA action in financing municipal electric distribution systems show clearly that the modification of policy which was supposed to have followed the President's recent conference with electric utility executives to discuss national power needs in case of war has not been made. Instead, the policy of using federal funds and federal prestige to depreciate or even destroy the value of the property of privately owned electric utilities has been made more definite.

These happenings should be a cause for concern by all, regardless of political affiliations or views on the controversial question of public versus private development of power, because they go contrary to the basic principles of our system of government. Though the utility properties actually affected are still few in number, the threat to all investment in electric utilities has demoralized the whole utility industry and has held up a vast amount of new construction which if released would go a long way toward restoration of national prosperity.

Testimony in the TVA investigation has swept away the last wisps of the smoke screen behind which the TVA has carried on in the past few years. It is now clear that power generation and its sale is the main objective of the TVA. Efforts are centered not on selling power to new industries and new customers on the farm and in the home but on taking away the customers of existing electric utilities. Naturally these utility companies objected, especially to the piecemeal dismemberment of their systems which the TVA proposed. And as the TVA was unwilling to buy at what the owners thought their property worth and did not have the right to condemn, leaving to the courts the fixing of a fair value on the property, it set about to force a sale through threat of building duplicating distribution systems by aid of PWA funds. Property rights were thrown to the winds and the "due process" clause in the Constitution was torn to shreds by men who, presumably, would be the first to condemn similar high-handed tactics on the part of others.

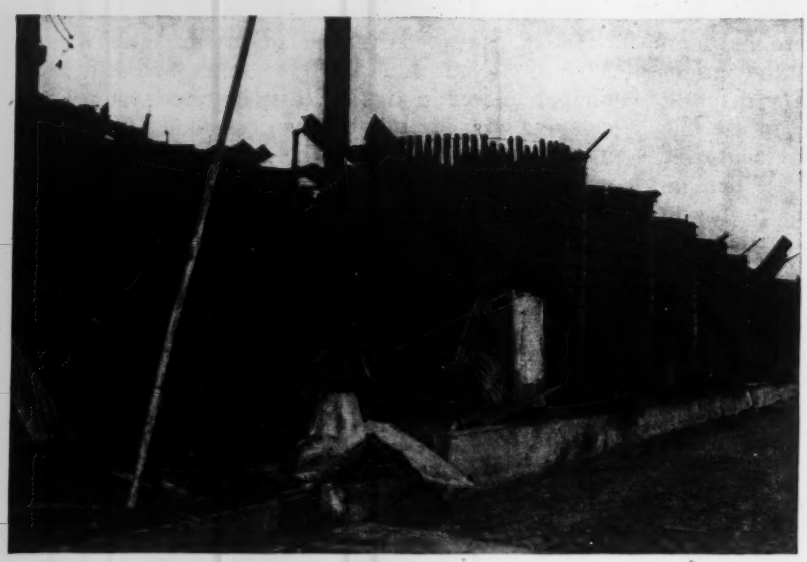
But the Tennessee Valley is not the only place where the Administration's destructive policy is effective. Scattered over the country are cities which have applied to the PWA for funds to build municipal power plants or distribution systems to compete with existing companies, some fifty in all. Most of these have been held up while the cities went through the form of offering to buy the existing facilities, following a policy adopted by the Administration last summer when it was criticized for using federal funds to destroy existing property values by building competing plants. Recently, however, PWA Administrator Ickes announced that a grant for a municipal distribution system had been approved due to failure of purchase negotiations.

What happened in this case is significant. The city offered the Mississippi Power Co. $232,000 for properties which the company valued at $536,366. When the offer was refused both parties filed briefs with Mr. Ickes, who made a finding that $269,000 was a fair value. The company would not accept, and so its property is to be made valueless through the construction of a federally subsidized system. It should be noted that neither the courts nor the state public service commission nor a disinterested mediator acceptable to both parties was made a party to this proceeding. All the accepted safeguards of our governmental system were sidestepped.

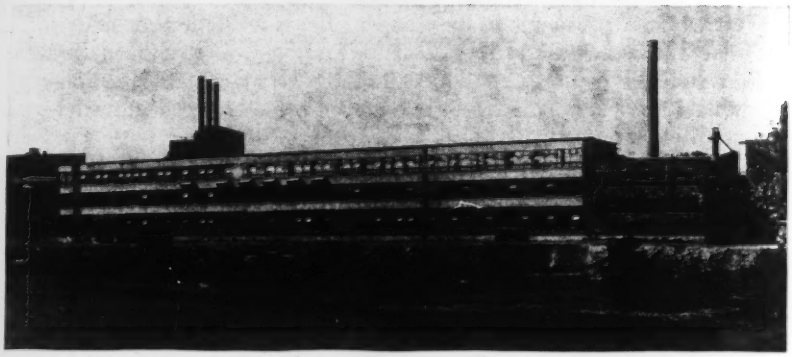
Most people will admit that the electric utility companies have abused their monopolistic position at times and that our system of regulation has been unsuccessful in entirely eliminating these abuses. But that is no justification for resorting to still more flagrant abuses of power in return. That is the significant consideration in the present situation. It should have the thoughtful study of Congress. Regulation of electric utilities by competition from publicly owned and operated power systems appears to be both unnecessary and potentially full of opportunities for abuses worse than those of the present system. But if that system is to be adopted, even in part, it should be adopted by Congress and so hedged about with limitations as to minimize its destructive effect.

Regular expansion of our electric generating and distribution systems is one of the major forces working for continued prosperity of the nation. That expansion has been checked by the high-handed way in which a few influential men in high places have sought to promote public development of power. If the country is get back to a prosperous condition quickly its power policy needs to be put on a sound and equitable basis.

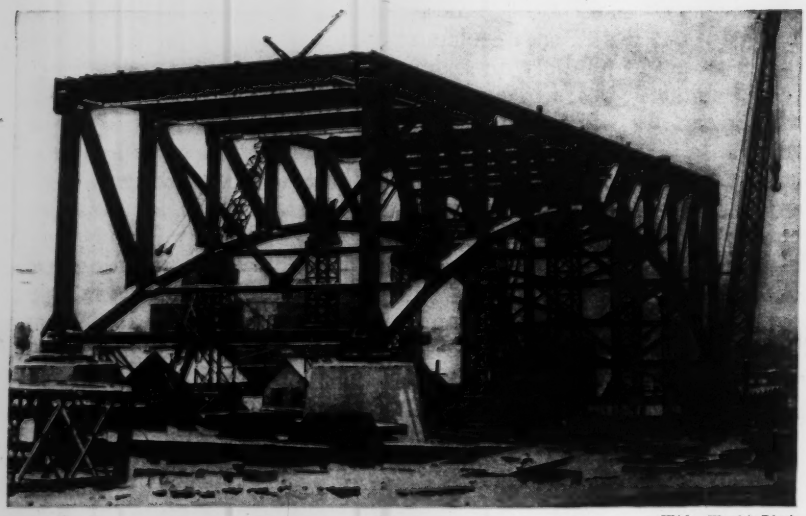
PICTURES IN THE NEWS



IT'S NEWS—when a water plant burns. Most of the tanks, the alum plant, chemical storehouse and boiler room were destroyed early last month when fire swept the Willard filter plant at Denver. Built in the early Nineties, this old plant consisted of wooden tubs with false bottoms into which screen cages for underdrains were screwed. The charred flume at top left is the supply conduit.



BRIDGE FOR CLEVELAND. This view was made as workmen completed the superstructure of an approach section of the $6,000,000 Main Avenue high level viaduct over the Cuyahoga River at Cleveland.



Wide World Photo

DIFFICULT FOUNDATION conditions were combatted by engineers of the Austin Co., who built the addition (above) to the Clifton Paper Board Co. mill at Clifton, N. J. The mill is located on a neck of land between the Passaic River in the foreground and an old canal at considerably higher level, behind. This condition makes the site subject to subsurface seepage at all times. Base for the building and the heavy but delicate board machines is a concrete mat founded on a layer of sand and gravel.

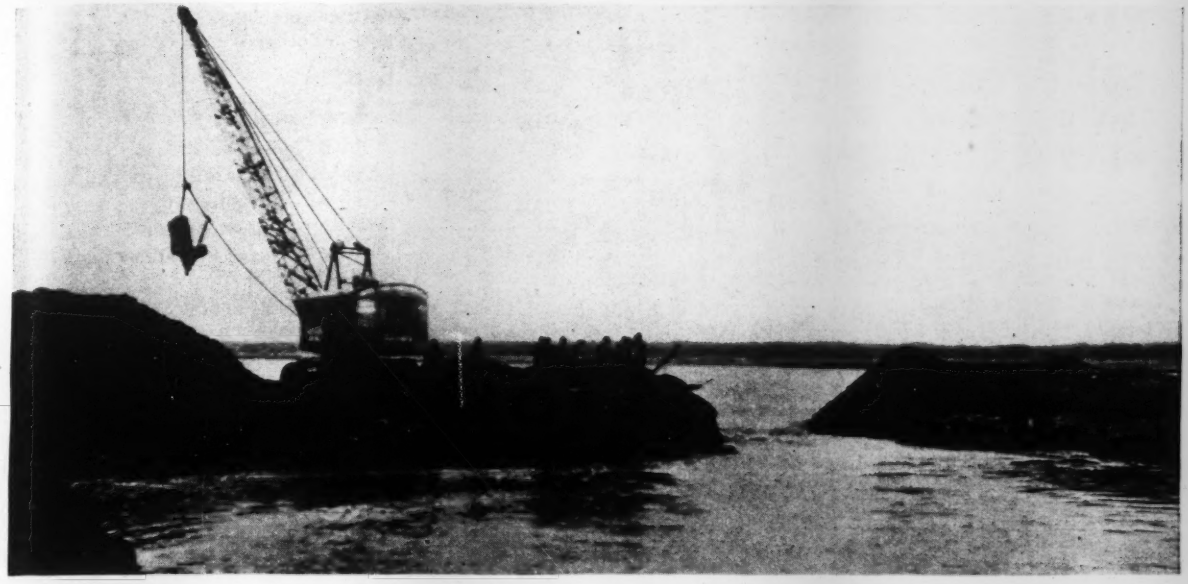


FIG. 1. TAKING OUT THE PILOT CHANNEL PLUG FOR THE FIRST MISSOURI RIVER CUTOFF

Big Muddy Gets First Cutoff

LT. COL. W. M. HOGE
District Engineer, U. S. Engineer's Office, Omaha, Neb.

Fight against Missouri River's struggle to cut off St. Mary's Bend is abandoned by army engineers who adopt new Mississippi practice of fostering cutoffs

YIELDING to the persistent demand of a river for a short cut, army engineers have completed the first planned cutoff on the Missouri River. It is located not far south of Omaha, Neb. and just north of where the Platte discharges its detritus-laden waters into the Missouri. At this point the Missouri makes a long loop to the east known as St. Mary's Bend. The geography is indicated by Fig. 2 which shows graphically the works of the original plan to preserve the long channel around the loop.

In the original design in which the alignment followed the existing thalweg of the river, it was necessary to increase the channel length to provide satisfactory bends for navigation and high-water flow. Preliminary studies indicated that the river in this section could be developed with standard regulatory structures, considering the special hydraulic characteristics presented, provided the upstream concave bank revetment work was reinforced to forestall a natural cutoff. Adoption of a cutoff plan was discarded because auxiliary dredging for channel regulation was not considered economically feasible and because the cost of moving the river to a cutoff location by regulatory works would have been tremendously expensive.

Construction operations begun in the fall of 1934 were prosecuted diligently until the fall of 1937. Development of the designed alignment was slow due to the river's stubbornness in seeking its shorter course. Repeatedly, completed works were breached because of channel short cuts. The orginal plan of development was not effective in guiding the river to its longer length and the maintenance charges on existing structures were becoming excessive. Although upstream protective works were in place, a natural cutoff was still possible.

The general success of cutoffs on the Mississippi and the continued success of minor auxiliary dredging in this district gave sufficient reason for a redesign for this particularly troublesome section. A restudy indicated that the cutoff would be successful and that savings in construction and navigation costs would accrue without detrimental effect on flood discharges. The length of the revised channel is 4.2 miles shorter than the original design and 2.56 miles shorter than the thalweg length in October 1937.

The procedure planned for the cutoff was the construction of an 80-ft. pilot canal, cut to water surface elevation by dragline, to be followed by dredging to 16 ft. below the construction reference plane. The river was to be directed into the new channel by training works and the old channel gradually was to be closed by dikes as the new one developed.

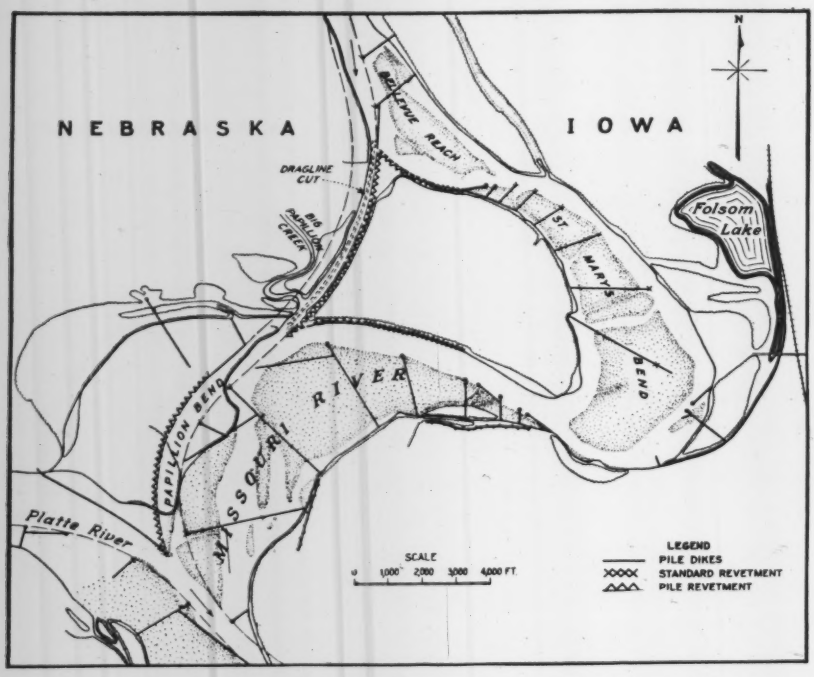


Fig. 2. First planned cutoff on the Missouri River at St. Mary's Bend showing the regulating works built to preserve the old long channel.

The concave bank of the new channel was to be protected by standard Missouri River riprap revetment.

Operations began on Feb. 15, 1938, when four draglines were put to work in a concerted effort to open the canal prior to the time of the usual April rise. A surprise March rise of unpredictable proportions dictated the decision to limit the canal width to 40 ft., for the greater part of its length. On March 15, 1938, the canal plug was pulled and the river allowed to follow the shorter course. Although the effective canal width was 40 ft. at the time of high water the alluvial soils were readily eroded for the accommodation of a large percentage of the total highwater flow. The canal developed rapidly in both depth and width so that by April 25, 1938, the measured discharge through the canal was 10,600 sec.-ft., 57 per cent of the total river flow. The canal had widened to a width of 350 ft. and had cut back to the designed concave bank alignment where government and contract forces held it with standard pile revetment construction.

The controlling depth in the cutoff is 13 ft., which obviates the necessity for dredging except as needed to correct the entrance conditions to the cutoff. Heavy silting in the old channel along the previously designed alignment has accompanied development of the cutoff.

Mosquito Control Progress In California

MOSQUITO-ABATEMENT districts in California number 24, nine of which are in counties adjacent to San Francisco Bay, where practically complete control has eliminated the swarms of large and vicious day-biting mosquitoes that formerly infested this area during spring, summer and winter, owing to the mild climate. From the annual report of the Alameda County Mosquito Abatement District it appears that in 1937 the work in this county cost $36,907 (less than 30¢ per family), and has cost from $30,000 to $45,000 annually since 1930. This district, with an area of 320 sq. miles, has a population of 460,000 and an assessed valuation of $421,000,000.

Particular attention was given to the *Theobaldia Incidens* species, which was greatly reduced by oiling creek beds up to their sources. Entomological opinion has been that this species seldom attacks human beings and is not a strong flier. Local conditions, however, led to a special study of the species, from which the following conclusions were presented: (1) it does attack human beings, (2) it breeds preferably in shaded pools in creek bottoms in the hill area, (3) it is most prevalent in spring and early summer, after the small hill streams begin to recede, (4) it is a strong flier and will migrate several miles in search of a blood meal.

Oil spraying was applied to 2,492 acres of marsh, 343 miles of creek and ditch, and 46,271 miscellaneous breeding places, including 37,188 catch basins or sewer inlets and 6,930 cesspools. When there is serious flooding, as has occurred with increasing frequency in recent years, the water cannot be drained fast enough from the marshes, so that breeding occurs unless checked by oiling. Certain built-up areas are without sewers and a detailed house-to-house survey was made to locate, examine and map each cesspool and septic tank, in order to save time for the inspection and oiling crews. Experiments have been made with pyrethrum larvicides, but while they are effective the cost doubles that of oil.

Silting of outlet channels and sloughs, with increasing difficulty in draining adjacent marsh lands, is becoming a serious problem. Dredging some of these channels is necessary for flood protection, but in others it is solely for mosquito protection. As a result of neglecting drain maintenance, it is stated that where a manufacturing company neglected this work one winter it was afflicted in July with an infestation so severe as to curtail outdoor operations and force workmen to wear netting hoods and gloves.

Possibility of Pacific airplane transmission of mosquitoes was a subject of special investigation, as the U. S. Public Health office at Honolulu reported the finding of an *Anopheles Maculipennis* mosquito in a Pan-American clipper from Alameda. There was fear that malaria carriers might be introduced in this way, but this particular species is not found near the Alameda air-base and further investigation identified the insect as the *Theobaldia Incidens*, already mentioned. Harold F. Gray is engineer and executive officer of the Alameda County Mosquito Abatement District.

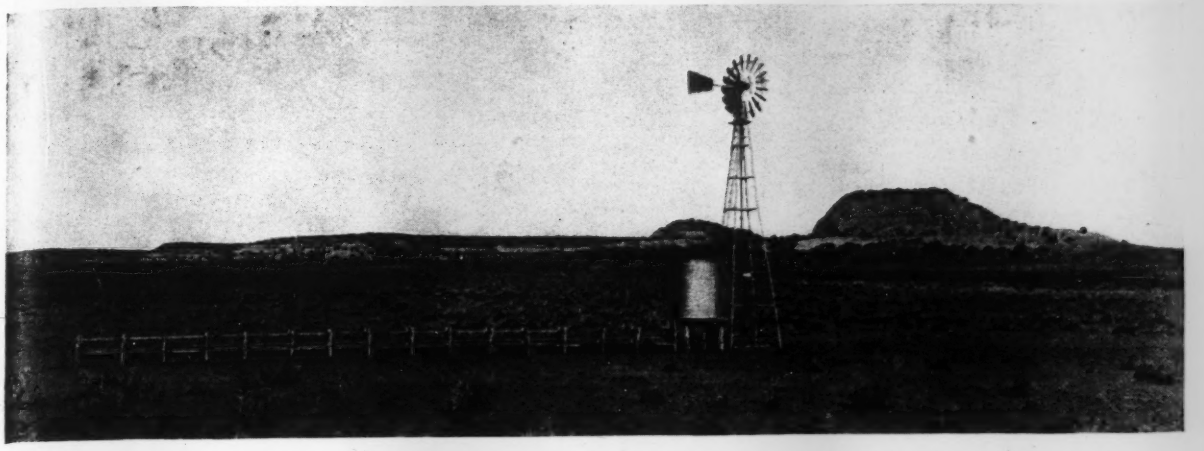


FIG. 1. WINDMILL, STORAGE TANKS AND TROUGHS FOR STOCK-WATERING ON A UTAH RANGE

Wells On the Public Range

GERALD C. WARING

Formerly, Senior Geologist, Division of Grazing, U. S. Department of the Interior

Development of shallow groundwater supplies is making available large areas of land otherwise useless for cattle grazing

ONE OF THE RECENT improvement measures on public land in the West used for cattle grazing, has been the development of watering places. In certain localities where water is badly needed to graze the range efficiently, a well of relatively small yield may make available several thousand acres of otherwies inaccessible feed. Because surface water supplies are difficult to develop in many of the grazing districts chief dependence has been placed on the sinking of wells.

Most of the public domain has been grazed on a "first come first served" basis by comparatively large stockowners, with whom the stock-raising homesteaders had small chance to compete successfully. As a result, the open range gradually became overstocked and overgrazed to the extent that some of the large operators found it to be unprofitable. And today in most sections of the arid country not more than ten cattle, or five times as many sheep, can be grazed successfully on a square mile of range.

To correct abuses, Congress passed the Taylor Grazing Act, which became effective in June 1934. Under it the Secretary of the Interior is authorized to issue permits for the grazing of livestock on public land within the boundaries of established grazing districts.

By the amendment of June, 1936 to the act the land which could be administered in grazing districts was increased to 142 million acres. The approximate total of vacant, unappropriated, and unreserved land amounts to 172 million acres or about 270 thousand square miles, an area about two and one-half times the size of Arizona.

The public land in Nebraska, North Dakota, South Dakota, and Washington comprises small, scattered tracts unsuitable for administration by inclusion within grazing districts. However, in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, and Wyoming grazing districts have been established, and a nominal grazing fee is charged. The periods for which grazing privileges are granted vary from year-long use to six weeks in the various districts. Many factors other than climate frequently are considered in determining the periods of use.

Range of improvement work

Of the money obtained from grazing fees 25 per cent is returnable to the district from which it is received for use in range development, such as watering places, drift fences, holding corrals, and truck roads and trails. This improvement work on the public land within grazing districts has been accomplished largely by the CCC.

Local stockmen have been much interested in the development and improvement of watering places, and much of the work accomplished has been of this character. Improvement of existing springs by increasing the water flow, if possible, and construction of tanks, and then the development of additional watering places by erection of dams and reservoirs, has been the general procedure. In many areas such natural water supplies cannot be satisfactorily developed, and it has been necessary to sink wells. In a number of sections the wells form the best supply.

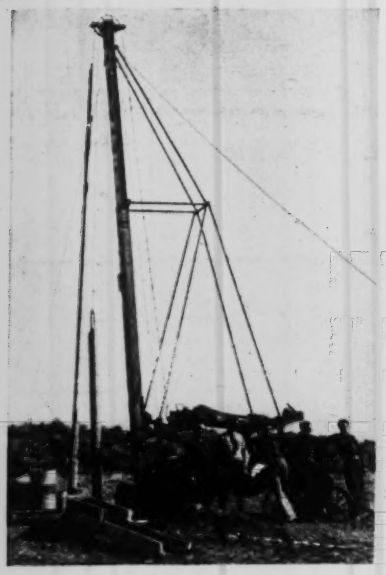


Fig. 2. Well rig and crew employed on a typical range installation.

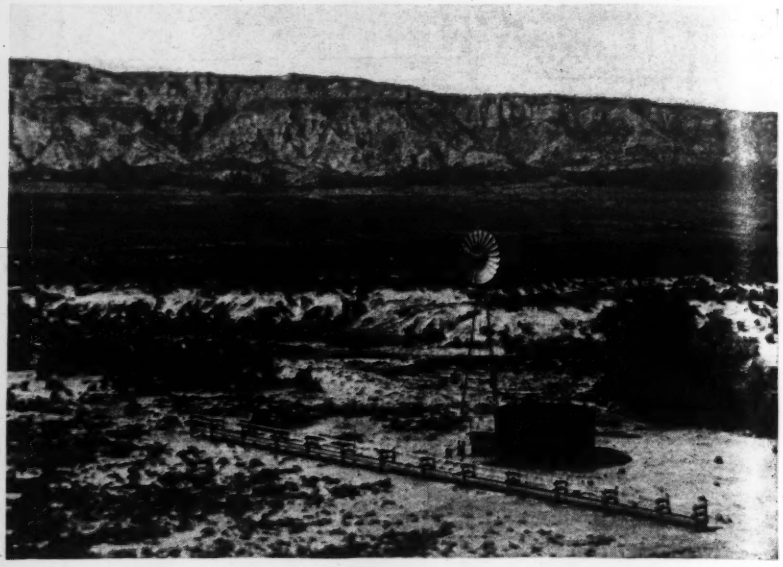


Fig. 3. In the sheep raising country is found the long watering trough and a big storage tank supplied by wind-driven pump connected to a well.

In a few areas of shallow water, wells have been dug. In general, however, it has been more feasible to drill wells, even where the depth to water may be only 30 or 40 ft. This method has also proved to be more economical and safer.

For stockwater, the sinking of wells to a depth of more than 500 ft. cannot generally be justified because of the initial expense involved in the purchase of machinery and the continuing expense of maintenance and repair. The average outlay to drill a well 200 to 300 ft. deep, equipped with windmill, tank and troughs, is about $700. Drilling cost is about $200; casing, $200, and lifting and storage equipment about $300. Small engines for pumping in most cases have been unsatisfactory when left to the operation of various stockmen.

Local work done

During the drought summer of 1934, before the Division of Grazing was organized and before it could acquire the facilities for the work, numerous wells were put down by local branches of the Federal Emergency Relief Administration. About 100 wells were sunk on the public domain in Utah and nearly twice this number in Nevada. The work thus inaugurated was carried forward in 1935 by the Division of Grazing, and it assumed the maintenance of the public wells within grazing districts.

In several of the desert valleys in Nevada and southeastern California water has been obtained at moderate depths in the deposits of sand and gravel. In other valleys, containing playa lakes and deep deposits of silt and clay, wells have been successfully drilled along the valley borders and adjacent alluvial fans, where the deposits are coarse enough to yield ample supplies of good water.

Location of water

In a few localities flowing artesian wells have been obtained. However, it has not been advisable, because of the cost, to prospect for deep artesian water in some places favorable to its presence, where shallow wells and windmills can more cheaply provide stockwater. Several flowing wells were obtained under rather unusual artesian conditions along a narrow zone in western Colorado, by drilling into steeply-dipping sandstones a short distance from the outcrop of these layers.

In some upland regions there are local areas of excellent grass range, and while these are preferred to the "browse" range of the lower slopes, they are useless for cattle raising because of lack of watering places. In some places where groundwater is not likely to be found several successful wells have been drilled. In areas of fractured lava or of weathered granite sufficient water for stock use can usually be found at moderate depths, but in limestone, shale, and quartzite formations the chances for water are slight. In the latter the best possibility for well water has been found to be at the mouths of ravines opening from the steep slopes to more gently sloping lands.

On the plateau of eastern Utah several wells obtained abundant water at shallow depths from the porous Navajo and Wingate sandstones, whereas other wells not far distant but drilled in more shaly formations yielded only scanty supplies of alkaline water.

Status of projects

To the end of July, 1937, the Division of Grazing had drilled 109 successful wells, and 142 other locations had been approved. Work on 13 wells had been suspended, chiefly to await material and equipment, and 10 unsuccessful wells had been abandoned. The latter in the majority of instances were drilled in unpromising localities where water was greatly needed in order to graze the range land efficiently. In such areas one well of only small yield may make available several thousand acres of otherwise inaccessible feed. Prospect drilling will therefore be amply justified in many areas even less promising than some of those which have already been tested.

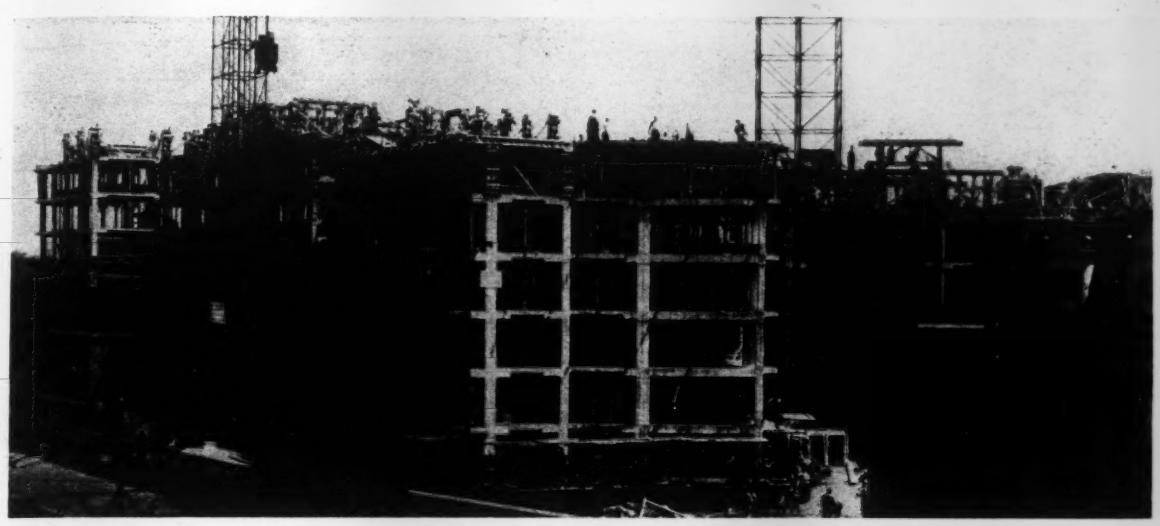


FIG. 1. TWO-WAY SLAB AND RIGID FRAME CONCRETE DESIGN ARE FEATURES OF NEWARK APARTMENTS

Fast Work on Reinforced Concrete Apartments

J. Di Stasio

Consulting Engineer, New York City

Modern design principles applied to large development of four connected units aggregating 792 rooms, built in eight months at Newark, N. J.

Late in January, 1938, a shovel started excavation at the site of the MacEvoy Court, Roseville and Seventh Aves., Newark, N. J. On Oct. 1, eight months later, tenants moved into the completed structure, a reinforced concrete apartment house consisting of four connected units housing 272 familes in 792 rooms. The development is of unusual interest in several respects. Some new principles of rigid frame design have been applied, which will be described in detail later. Though there was little repetition of layout, the fast construction schedule was made possible by exceptional coordination of all trades. Use of plywood forms of neat design speeded up concrete work.

The building is divided into four connected units—two of nine stories and two ten stories high with basements. It has a total volume of over 2,050,000 cu.ft., and covers an area of more than half an acre. The apartments are served by five elevators. The arrangement of the beam framing to follow, without exception, the partition lines permitted adoption of the unusually low story height of 8 ft. 6½ in. Each unit is provided with a separate entrance. Suites consist of from one to six rooms with two, three, and four-room apartments predominating. Room measurements average 12x15 ft. for bedrooms, 12x18 ft. for living rooms, 9x10 ft. for kitchens, and 7x5 ft. 8 in. for bathrooms.

The structural framework is entirely of reinforced concrete, designed as a rigid frame and founded on concrete piers to rock. Skeleton walls are 4-in. brick backed up between columns with 8-in. terra cotta tile; membrane spandrel waterproofing was applied over all openings, and inside surfaces were dampproofed before application of plaster. For all public spaces and between apartments, partitions consist of 3, 4 or 6-in. gypsum blocks plastered, and within apartments, of 2-in. plaster on metal lath stretched between floor and ceiling. The use of plywood forms eliminated the necessity for plastered ceilings, which were cleaned of fins and painted directly on the concrete.

The project contains 226,000 sq.ft. of supported floors, 4 to 4¾-in. thick, designed entirely by the A.C.I. two-way slab code. The architectural layout, due to the odd-shaped plot, was such that except for some minor duplication in Unit No. 1, no two panels on a floor are alike (Fig. 2). In fact, in the class of buildings to which the two-way slab system is particularly suited, much uniformity of framing rarely exists. The need for a rapid and general method of design applicable to all variations of adjacent spans is therefore apparent. The A.I.C. regulations meet these requirements in every respect.

Design procedure

Following the procedure laid down by the A.C.I. code, span directions A and B were adopted and kept the same for all slabs throughout the

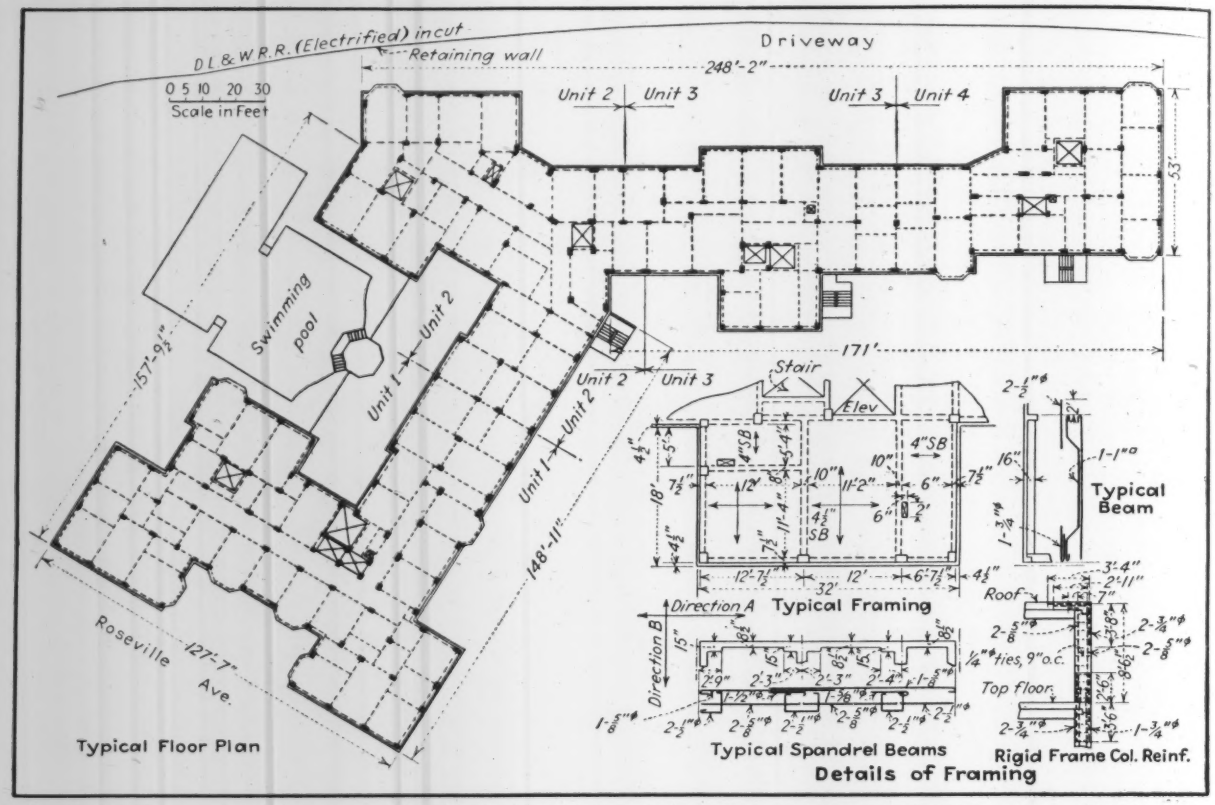
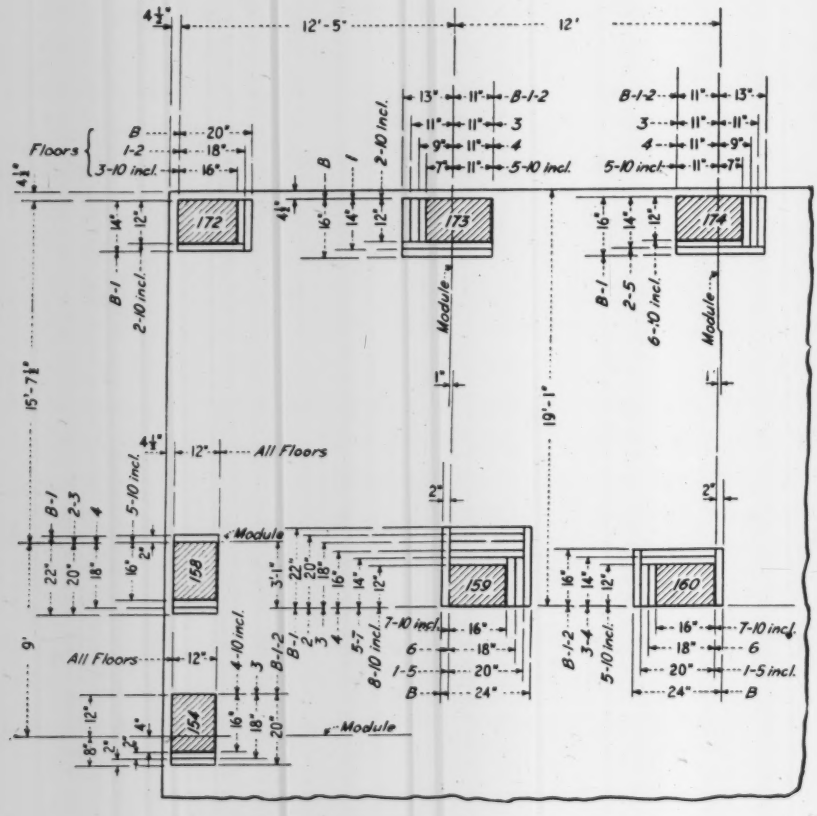


Fig. 2. Standard floor panels were not possible because of the odd-shaped site, but design difficulties were avoided by working out a simplified procedure of calculations. In the inset are several typical design details.



job. Effective span ratios $F_A A/F_B B$ were next determined in a few minutes by simple slide rule operation for all panels and marked on a working plan. With these as a basis, values for equivalent uniform load coefficients were picked from the tables (See Table II, Slabs Supported on Four Sides, A.C.I. *Journal*, Jan.-Feb. 1936) and multiplied by the unit load; from this point on, each direction was treated the same as ordinary one-way construction. In spite of the involved nature of the architectural layout, computations using the A.C.I. code were concise and simple, and comparable in length to those required for other types of concrete construction.

Because of economies involved and the more correctly proportioned structure resulting therefrom, maximum bending moments were determined by considering slabs as contin-

Fig. 3. Column form setting was simplified by referring all column dimensions and locations to fixed points and lines. One plan, of which the above sketch is but a small part, served for every column on all floors.

uous structures, and beams and columns as rigid frames using the fixed-point method (See *Structural Bending Moments Simplified*, by T. T. Berg). This analysis was greatly facilitated by the use of equivalent uniform slab loads as, when applying loads to the structure, it was only necessary to add these to other contributory loads such as walls, partitions, etc. The fixed-point method resulted in considerable time saving over other methods of analyzing continuous structures as it eliminated the solution of simultaneous equations or the necessity of balancing fixed-end moments, and final results are obtained at the end of a single cycle of operations. Because of the small effect on moments of variations in column stiffness from floor to floor, it was found unnecessary to make separate frame calculations for each tier. Computations were based on the top floor frame with adjustments for increased stiffness in lower stories where required. Beam sizes generally were controlled by the support moments.

Serious consideration was given the question of the effect of temperature on the structure, and first intention was to provide an expansion joint through twin columns at the center of the building. Studies made of existing structures indicated the generally unsatisfactory behavior of such joints. In view of these considerations and giving due regard to the shape of this particular building, final decision was made to eliminate all expansion joints with the thought in mind that any small cracking or checking would be more than offset by the reduction in expansion joint trouble and repairs.

Investigation was then made of the shears produced in the columns by a 20-deg. difference in temperature between roof and top floor after making due allowance for counteracting changes in length from the direct temperature stresses. On combining the resulting frame moments with those from gravity load at 33 per cent increase in working stress, additional reinforcement in certain groups of columns near the ends of the building and where changes in direction occurred was found to be required. Below the top floor, the gravity load in the columns prevented the development of tension, and no further addition to the normal reinforcing was made. All construc-

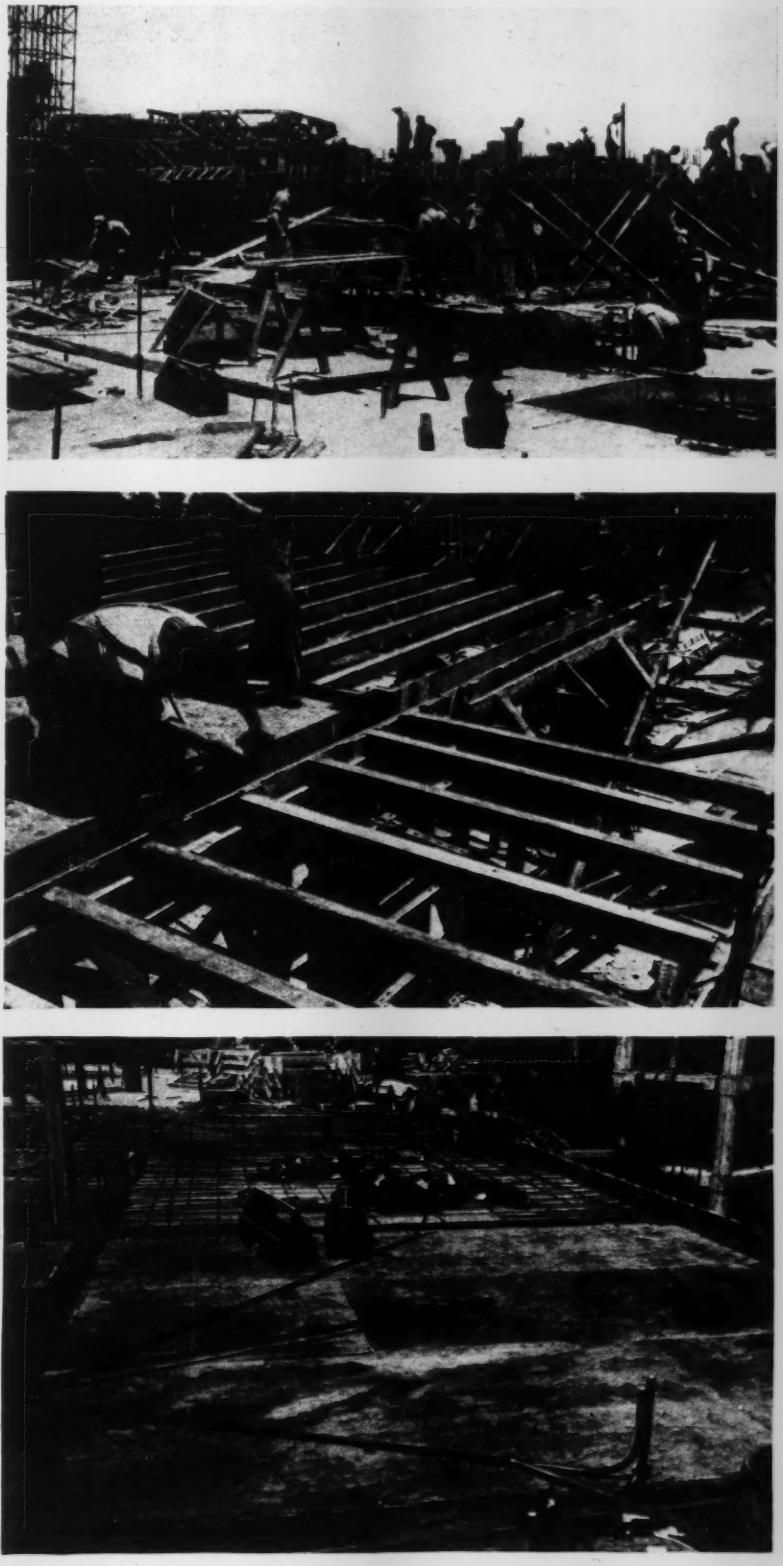


Fig. 4. Three steps in formbuilding. First step was to set up the plywood column forms (top) from the plan shown in Fig. 3; next was the erection of beam forms and floor joists, (center) the beams being carried on T-posts, the joists resting loosely on rails on the beams; final form step was to floor the panels with plywood sheets (bottom).

tion joints were doubly reinforced with additional top bars.

The design plans showed complete reinforcing details with special schedules for the two-way reinforced slabs. Detailing was complicated by the presence of many pipe and vent shafts cutting through the panels. Bar spacing was closed up at these points and special diagonal rods placed at the corners of all openings. Clear and comprehensive schedules were required for the field showing the definite location both in spacing and extension of all bars, and picture diagrams were made for all special conditions. In addition to the regular schedules, elevations were drawn for all beams as an aid to the proper placing of the steel.

Top slab bars were arranged in mats in the shop, and placed as units over the beams. They were supported at the proper height by ½-in. round spacer bars resting on 4x4-in. concrete blocks. Labor regulations required all rods under ¾-in. to be cut, and all reinforcing to be bent on the job. After cutting, bending and tagging, the reinforcing for each complete beam or slab was bundled as a unit and delivered by a V-shaped elevator hopper with tripping device to the various floors.

On account of required architectural clearance, changes in size of columns from the upper to the lower stories were limited in various directions, making it generally impossible to maintain the same center lines from floor to floor. To facilitate the carpenter work, composite floor plans (Fig. 3) were furnished showing complete column dimensions and locations from roof to basement; thus, carpenters had to work with but one floor plan in laying out column forms. These plans were found extremely useful in the field.

Design details

An interlocking tile unit was used. All window and door jambs were formed with the tile cells running vertical, so that a smooth surface was obtained. As an extra precaution for drainage in the exterior walls, weep holes formed by drainage wicks were provided at all stone joints and spandrels, generally about every 5 ft. (Fig. 5).

For weatherproofing, main reliance was placed on the quality and workmanship of the mortar and brickwork. The back-up tile was parged with a ½-in. coat of waterproof mortar and then the face brick laid very carefully and all joints raked. This extreme precaution was taken because considerable saving was effected in not using any exterior wall furring but using only a dampproof coat.

All window sills were 2-in. marble slabs. It was found that the cost of these sills was comparable to cement or brick sills and they furnished a far superior exterior appearance. Cast stone was used for all band courses.

The original specifications called for wood door bucks. However, combination steel bucks and trim were substituted at no additional cost.

Typical details of the form work are shown in Fig. 4. For the floors, ⅝-in. plywood forms were used throughout. These were so designed that they were easily handled, besides permitting easy stripping and erection. Only sufficient forms were provided to erect one floor at a time.

As the progress schedule required the completion of one floor a week, a total of 25,000 sq.ft., it was necessary to strip forms completely in three days. The original specification called for quick hardening cement, which was used at first. However, trials revealed that a redesigned mix using ordinary cement was satisfactory, and met the three-day stripping requirement for the forms. All concrete was designed for 2,500 lb. An addition of 10 per cent by volume of ¼ to ⅜-in. pea gravel was found to help the mix workability, permitting a lower water-cement ratio with increased early strength. The progress with which the job was completed and the resulting excellence of the concrete work more than justified the expense involved in using controlled concrete under competent inspection.

Ready-mixed concrete was used, delivered to the job partly mixed. The adding of required water and thorough mixing were timed so that there was no delay in delivery of concrete by the trucks. The concrete plant consisted of two main towers with hoppers from which the concrete was distributed by buggies. During placing, the use of vibrators was found very beneficial in securing a dense and solid structure.

Excavation was started about the middle of January, 1938, and by the end of June the roof had been poured. Walls and partitions closely followed the concrete work. The building was completed for occupancy on Oct. 1.

Fig. 5. A detail of wall and spandrel construction. Note the waterproofing at the spandrel and the interlocking tile for the window jamb. The wick at the lower right forms a weep hole in the wall.

Direction

The Clifford F. MacEvoy Co., of Newark, are the owners and builders. Mr. MacEvoy gave the project his personal attention; Frederick Rabbe was general superintendent. Concrete control was furnished by the Howard Inspecting and Testing Laboratories, Newark. The general architect was Ernest Flagg, New York City. Walter Hooper, architect for the contractor, furnished all architectural details. Walter Eller was FHA representative on the project. Design and detailing of the structural work was provided by J. Di Stasio & Co., consulting engineers, New York City.

FIG. 1. A SNOW-CLEARED ROAD IN NORWAY

Snow Removal in Norway

HELGE SANDBERG
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The properties of snow affecting removal and a design of snow plow that has proved effective

INLAND NORWAY is a country of prevailing snow from the beginning of October until about the first of April. Also climate and wind cause variable conditions of snow. Therefore when the Norwegian State Railways set about a study of the possibility of autocar routes instead of branch rail lines snow became a major problem for consideration. The line selected for trial is known as the Selbu route from the sea inland at 63 deg. N. lat. and rising to 1,000 ft. above sea level. The study which was one of many details and experiments resulted in information on snow conditions that has general value and in the development of a snow plow that has proved highly successful.

Properties of snow

Experience disclosed that the frictional properties of snow are decided by its compactness, its moisture and the forms of crystallization. Other factors are the relative temperatures of the snow and the plow surface, and the form of the plow surface. If newly fallen snow is dry and cold, it is generally easy to deal with, and still more so if it is slightly damp. The difficulties begin when the snow grows wet and increase when it gets fully charged with water; then sliding surfaces may form independently in the mass of the snow, and packing will follow. If the snow has layers of different compactness, temperature and moisture, it may also be very difficult to clear in mass. Snow having temperatures below —12 deg. C. offers great frictional resistance.

Difficult conditions

The most difficult case of snow-removal occurs when wet snow covered by a layer of dry snow has to be cleared with a plow having a temperature below freezing-point. Under these conditions the watery layers of snow will freeze and cling to the plow. A mixture of hail and snow, granulated snow or newly deposited drift-snow is generally easy to clear, as these are usually dry and have temperatures below freezing point. But drift-snow undergoes transformation; shortly after having come to rest it becomes very hard and compact similar to ice but without losing its snowy appearance. Hard drift-snow is hard to compress and must be broken upwards when cleared.

Plow designed to fit

To meet these variable conditions a new plow was designed, after discarding several older forms of plows. In designing the new plow the following objects were sought:

1. Mobility and compactness; this was obtained by fixing a plow to the side of the tractive unit in such a way that it might be swung up and kept housed with the tractive unit.
2. A suitable dispersion of stresses in the unit; this was obtained by let-

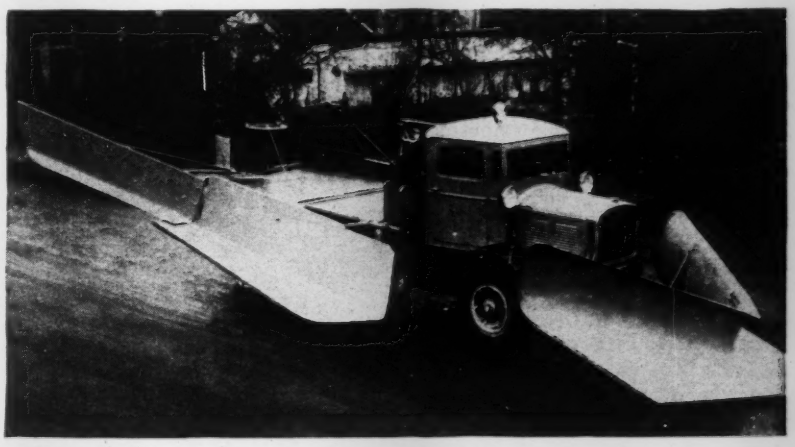

Fig. 2. Snow clearing unit designed especially to meet snow conditions on the Norwegian autocar roads that serve the state railways.

ting the vertical impetus from forces due to weight of plow and snowload, be taken up by an adjustable sledge-runner fixed to the plow. By this arrangement the rubber tires of the tractive unit are relieved from undue stress from vertical forces. The horizontal impact from friction, sidewise and endwise, were transmitted to the tractive unit, the frame of which was strengthened to absorb these stresses.

3. A plow-design insuring a clean snow-delivery at the smallest possible cost and use of tractive power. A snow "plow" has no relation to an agricultural plough; the latter is made for the purpose of cutting and turning over soil; a snow-plow has the sole purpose of lifting or breaking snow with the slightest possible resistance, and, as a matter of course, remove it without wasting energy in turning it over in the process.

Both experiments and reasoning indicated that curved surfaces on a snow-plow tend to increase frictional resistance and give an unclean performance. Consequently a side-wing plow was designed with inclined plane surfaces.

Dictated by Safety

SIDNEY M. SHAPIRO

Assistant Chief Engineer, Long Island State Park Commission

Design of new 10-mile parkway on Long Island embodies every safety device that experience has shown to be effective

CONTINUOUS and reasonable speed with safety has been the controlling objective in the design of the Northern-Wantagh State Parkway Extension in Nassau County, Long Island, newest addition to the arterial system in the New York metropolitan area. Opened to traffic Dec. 17, this ten-mile parkway has added distinction as the final link in a continuous 43-mile parkway from the Triborough Bridge (as well as from the World's Fair site and the new Whitestone Bridge) to Jones Beach park on the ocean front.

The Northern-Wantagh State Parkway Extension was planned in 1936 after the necessary right-of-way had been acquired by Nassau County and dedicated to the state of New York for parkway use under the jurisdiction of the Long Island State Park Commission. The right-of-way averages 350 ft. wide with additional width at the important crossroads.

Fig. 1. View east from the beginning of the project, showing the two dark ribbons of "main line", the accelerating and decelerating lanes of lighter color at entrances and exits and one of the parallel service roads.

No means of access for abutting owners along the parkway is provided, and public access and egress points are limited to intervals of about 2 miles, with the idea of reducing such points (where experience has shown many traffic accidents occur) to a minimum.

The roadway on the new project consists of two 25-ft. reinforced concrete pavements divided by a 9-ft. landscaped mall. Of the four lanes, the two outside lanes are 12 ft. wide and the two inside or passing lanes

SAFETY ON NORTHERN-WANTAGH PARKWAY IS SOUGHT BY:

1. Divided pavement
2. White, sloping curbs along black pavement
3. Single-lane entrances and exits
4. Accelerating and decelerating lanes at entrances and exits
5. Highway lighting
6. Pedestrian sidewalk
7. Grade-separated crossings
8. Level shoulders 8 ft. wide

13 ft. wide. The concrete mixture was colored with carbon black, in the amount of 3 per cent by weight of the cement, to reduce glare during daytime driving. Sloping curbs 3 in. high, along both the outside shoulders and the dividing mall, are constructed of white cement to furnish a pronounced contrast with the black concrete of the main lanes. The sloping curb design also serves to reduce the mental hazard of driving along the edge of a curbed roadway. Observations of the older sections of the parkway system, where vertical-faced curbs are used, indicate a waste of effective pavement width because motorists keep away from the curb. The new sloping curb should improve this condition. It should also aid cars, required to stop for repairs, to get off the pavement to the 8-ft. level, grass shoulders provided along both sides of the parkway for such contingencies.

At each exit and entrance, accelerating and decelerating lanes, 11 ft. wide, are provided outside of the 25-ft. width of main parkway. These lanes are paved with uncolored concrete to contrast with the black roadway lanes on the theory that the through motorist can easily follow the colored concrete pavement and avoid the uncolored side lanes provided for the motorist who is about to leave or enter the parkway. At the entrance driveways, the pavement is funneled down to a width sufficient to allow only one car at a time to enter the parkway; this design change results directly from accident records at the wider entrance points on earlier parkways where, on occasion, two cars have attempted to enter at the same time.

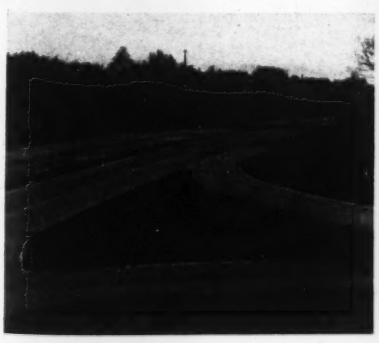

Fig. 3. Funnel entrances and exits are wide enough for only one car.

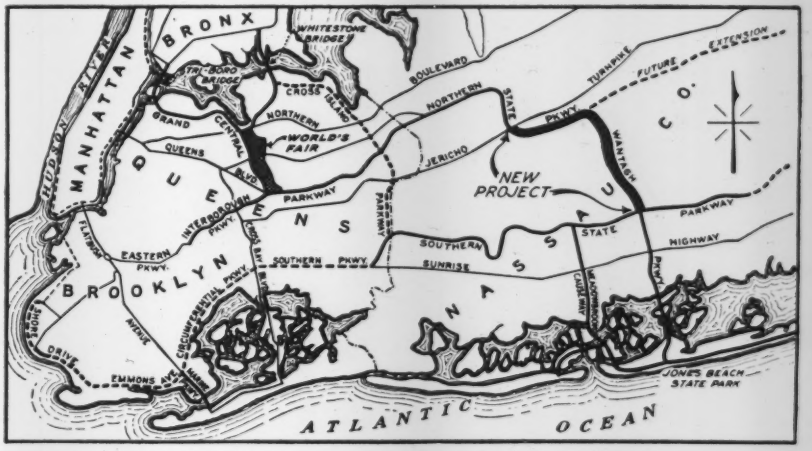

Fig. 2. Location of the 10-mile Northern-Wantagh Parkway which closes the last gap in a 43-mile grade-separated route from the Triborough Bridge to Jones Beach.

Another safety improvement contributed by past experience is an asphalt macadam sidewalk on one side of the parkway for its entire 10-mile length. Pedestrians have been prohibited from all previous parkways, but many hikers have persisted in using the grass shoulders. The new sidewalk will make their hiking safer and at the same time legal. Benches have been installed at regular intervals as an added attraction.

All of the intersecting crossings—17 highways and 1 railroad—are separated in grade. Access systems have been provided at 5 of these 18 crossings. The grade separation structures, all of rigid frame design and stone faced, include 11 single-spans of elliptical arch outline; 2 two-span vertical-leg frames; 4 single span, vertical-leg frames; and 1 steel rigid frame bridge with stone-faced abutments. The average span is 74 ft. Based on contract prices, the average cost per bridge was $80,000.

Automatic vehicle counters consisting of treadle units set in each lane of pavement have been placed at the north and south end of the project. Traffic information, thus obtained, will be used in analyzing accident records and for general information in the design and layout of future extensions of the parkway system.

Billboards, advertising signs or any other objects tending to distract the driver or to detract from the natural landscape are prohibited, and the right-of-way is suitably landscaped with topsoil, grass and planting as on other state parkways.

The new parkway is lighted by an improved modern system consisting of 400-candlepower incandescent lamps mounted on double-arm poles located along the center mall and spaced 175 ft. apart.

The design and construction of the new parkway was carried out by the New York State Department of Public Works in cooperation with the Long Island State Park Commission of which Robert Moses is president and Arthur E. Howland, chief engineer. For the state department of public works, Arthur W. Brandt is commissioner of highways, and J. J. Darcy is district engineer.

Fig. 4. Sidewalk and benches for pedestrian safety. Light standards in central mall not yet installed.

Cautions Regarding Land-Fill Disposal

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Use of land-fill method of garbage disposal raises problems of fill drainage, effect of slow decomposition and nuisance from a variety of rodents

The following thought-provoking discussion was inspired by the article, Land Fills for Refuse Disposal, by E. J. Cleary, which appeared in the Sept. 1 issue, p. 270. Drawing upon experiences both here and abroad Mr. Eddy makes a valuable contribution to current thinking on this controversial subject. Other expressions of opinion have been published during recent weeks in the Comment and Discussion section. —EDITOR

The land-fill method of refuse disposal as now practiced in New York is undoubtedly a big improvement over the uncontrolled dumping of mixed refuse. It seems desirable, however, to sound a note of caution before many cities adopt this method of disposal, apparently so attractive because of its cheapness.

In the first place, on account of its content of garbage and rubbish, a mixed-refuse fill can hardly be considered suitable as a building foundation without the use of piles. In England and Wales, J. C. Dawes, Inspector of Public Cleansing, Ministry of Health, has found the rate of settlement in "controlled tips" to vary from 1 in 10 to 1 in 6, depending upon the packing and the character of the refuse. At Seattle, Washington, where mixed refuse has been disposed of for several years by the "sanitary-fill" method, the paper, cardboard and other light, inflammable material is salvaged from the refuse before it is covered. (*ENR*, Nov. 23, 1933, p. 876). Hence the finished fill would seem to be less subject to settlement than at New York, where such light refuse forms part of the fill. Even so, the Seattle fills are approved by the city building department as suitable foundation for light structures only. Experience in New York itself, and elsewhere, with dwellings built years ago on refuse fills, has indicated clearly the inadvisability of building on such foundations unless piles are used. It is not clear that the present fills will be more suitable.

Speed of decomposition

If the requisite data were available, it would be interesting to compare the character and rate of decomposition of the organic material in the Fairfield and Pennsylvania Ave. fill in New York City with those obtaining in some of the "controlled tips" in Great Britain, where this method of refuse disposal has been given extensive consideration by the Ministry of Health. In the British tips, refuse is deposited in shallow layers, not more than 6 ft. in thickness, and the tipping face is kept narrow—where practicable, not more than 20 ft. in width. It is usual to form the tip in narrow strips called "fingers," which become in effect, soil-lined cells in which biological changes proceed independently.

The more perfect the seal, or cover, the more rapid the rate of fermentation and the higher the temperature within the cell, which means the more rapid disappearance of the organic matter. It is considered advisable to aim at 150 deg. F. for a period of 10 to 30 days. Usually, a period of 6 to 12 months elapses before the temperature of the refuse falls to that of the atmosphere and the refuse becomes "dead." In the New York fills where the "cells" apparently are 12 ft. thick and 200 ft. wide, decomposition is, in all probability, very much slower.

The element in refuse which is most subject to decomposition is, of course, garbage. In some cases where garbage has been deposited alone and covered with earth, decomposition has proceeded very slowly indeed. In recent years an ancient garbage dump, made by the inhabitants of Rome about 1,000 years ago, has been excavated and the material was found not to have decomposed thoroughly after all these centuries. A few years ago, at Greenwich, Conn., a sewer was built through an old dump where garbage had been deposited some 20 years before. During the construction the odors from the partly decomposed garbage were highly offensive. These instances tend to show that the so-called sanitary-fill method of garbage disposal is not really a method of disposal, but only one of covering, since the garbage remains in clearly recognizable but much more objectionable form. While it is true that at New York the garbage has rubbish and ashes mixed with it, these materials do not hasten the decomposition of the garbage but merely serve to dilute it.

Seepage and leaching

The article on New York City practice makes no mention of provisions for disposing of the drainage or seepage from the land fills, which has been a real problem at other sanitary fills. At San Francisco, for example, it has been found that one essential to success in an operation of this kind is a location for the fill such that seepage from it will flow directly into a large body of water (*ENR* Feb. 27, 1936, p. 314). During wet weather, storm water is bound to seep through the cover material and result in a leaching of the partly decayed organic substances. At very low tides during the winter, a black liquid occasionally is observed seeping out of the lower portion of the San Francisco fill. This seepage has an exceedingly disagreeable odor, but fortunately at that location it creates no nuisance, because it flows almost immediately into the bay waters. It is expected that seepage will cause a nuisance at sanitary

fills where adequate provision for handling it is not made.

It is noted that at the New York fills odors, flies and dust are successfully controlled by the use of creosote spray. No mention is made of vermin other than rats. In cities where the control has not been so effective, householders in the vicinity of refuse dumps have suffered severely from the vermin which breed in the dumps. In addition to rats and flies, trouble has been caused by mosquitoes, crickets, cockroaches, water bugs and sowbugs. Dayton, Ohio, for example, has had most trying experiences with invasions of gray crickets, water bugs and sowbugs, as have some European cities with crickets.

Although no trouble from fires is recorded on the New York fills, it should be borne in mind that unless extreme caution is exercised in carrying out fire-prevention measures, fires frequently occur, particularly where combustible refuse is present. Not only do such fills constitute a fire hazard to nearby buildings, but the odor and smoke from burning refuse are highly objectionable. Dump fires sometimes are extremely difficult to extinguish, due in part to the presence of gases. In Putnam, Conn., recent tests at a rubbish dump, containing some garbage and ashes, have shown the presence of combustible gas, at a depth of two feet below the surface, in material which had been deposited about three years earlier.

Another item which should cause many cities to hesitate before adopting the filling method of disposal for garbage and rubbish, as well as ashes, is the scarcity of dumping areas in the built-up sections of almost all cities. Officials charged with the responsibility of refuse disposal almost universally complain of the rapid exhaustion of dumping areas located within reasonable hauling distance. If the typical American city were to adopt the sanitary-fill method of disposal today, it would not be many years before all the convenient areas would be filled up. After that, the city would either have to use dumps in its outskirts, with consequent increase in cost of hauling, or else turn to some other method or methods of refuse disposal. It should be noted that in this case even clean ashes would have to be hauled great distances. The sanitary fill method thus uses up a valuable, present, natural resource at the expense of posterity.

Vibrations in Concrete Water Tanks

DEAN S. CARDER
U. S. Coast & Geodetic Survey

Tests on an elevated tank at Sacramento show vibration periods the same for tank full or empty

AN ELEVATED reinforced-concrete water tank can be so constructed that its period of vibration will be the same regardless of whether the tank is full or empty. This appears to be the logical conclusion suggested by recent tests by the Seismological Field Survey of the U. S. Coast & Geodetic Survey in cooperation with the Sacramento Water Department.

Sacramento has two concrete elevated tanks, almost exact duplicates, each with a capacity of 3,000,000 gal. and a diameter of 144 ft. The floors of the tanks are 70 and 77 ft., respectively, above ground; each is supported on 44 columns arranged in three concentric circles. The design of the tanks was described by Henry D. Dewell in *Engineering News-Record* Nov. 4, 1937, p. 752. As an item on its program of investigating vibrations in structures, the Seismological Field Survey recently set up instruments in one of the tanks and measured vibration periods under different conditions. During tests the light wind (about 5 m.p.h.) was probably the sole cause of vibrations.

The instruments used were a Labarre vibrometer and a medium-magnification Survey vibration meter. As the magnifications of these instruments are 10,000 and 1,000 respectively, and as they are unlike in construction, one served as a check on the other. They were set up on the steel platform inside the 6-ft. central manway that gives access to the roof and to the tank interior. Local disturbances were partially overcome by setting the instruments on cloth dampers. Additional observations were made on a stair landing 45 ft. high, on the ground floor and at several points on the ground as far as 450 ft. south of the tank.

Vibration periods observed in these tests are shown in the diagram,

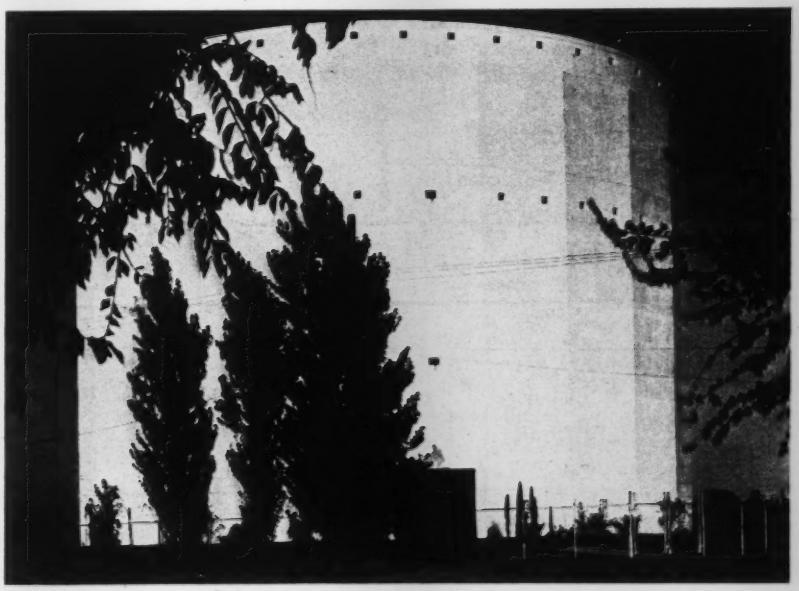


Fig. 1. One of the 3,000,000-gal. reinforced-concrete water tanks at Sacramento.

Fig. 2, where the solid line represents the dominant period; probably the fundamental period of the structure. This remains about 0.29 sec. irrespective of water level in the tank. The shorter period, indicated by a dotted line, probably resulted from some local disturbance; it does not appear in records made at the 45-ft. level or on the ground. The 0.29-sec. period, on the other hand, is definite at the 45-ft. level and on the ground within the tower but is indefinite on the ground away from the tank.

Observed amplitudes (maximum displacements from rest position) at the 88-ft. level range from four to twelve millionths of an inch in the 0.3-sec. period. At the 45-ft. level and on the ground (zero level) the amplitudes were 5 and 2.5 millionths of an in. respectively: Results on the two instruments checked. Direct comparison of amplitude cannot be made because tests at different levels were not simultaneous; very roughly, however, amplitude ratios were 7:5:2½ at the 88-ft., 45-ft. and zero levels respectively.

In tests on other structures it has been noted that vibrations of the structure are carried in appreciable amounts into the ground, particularly where the ground is naturally yielding. The Sacramento tank supports, however, are so rigid that the relative displacement of the ground under the tank is high. Possibly there may be a suggestion that the 0.3-sec. period observed in the tank belongs to the ground and was merely forced up into the structure from the ground. Support for this theory disappears when it is remembered that the ground period away from the tank (determined by measurements on microseisms) was 0.2 or 0.14 sec. and the amplitude was one millionth of an inch; on the other hand, under the tank the period was 0.3 sec. and the amplitude 2½ millionths of an inch. The 0.3-sec. period became imperceptible on the ground record at a distance of 50 ft. from the tank. Furthermore, if the tank were merely riding on an oscillating ground the amplitude at the top should be the same as on the ground: this was not the case in the tank tests.

Perhaps the most striking information arising from these tests is emphasis on the difference in reaction of elevated steel and concrete tanks used for water storage. From tests previously made on elevated steel

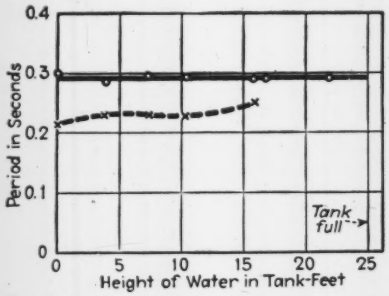


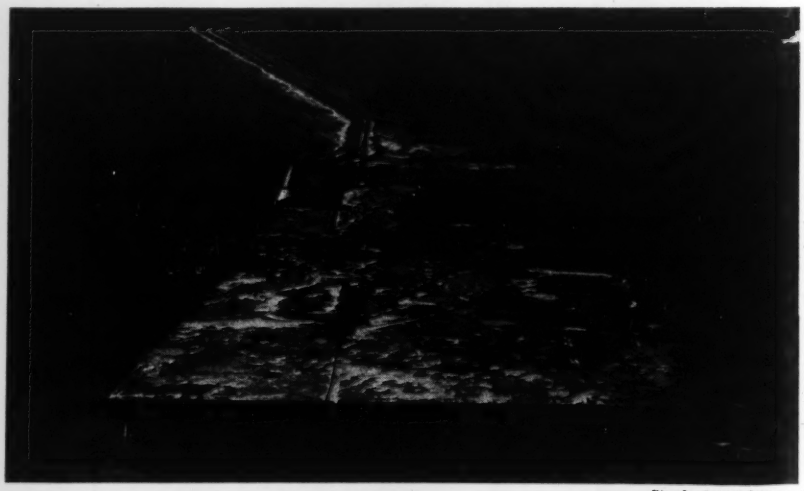
Fig. 2. Two vibration periods were observed in the elevated concrete tank, one being dominant.

tanks (50,000 to 100,000 gal.), there are records to show that the periods of the two are about the same but their amplitudes, with tank empty, are 20 to 100 times the amplitudes found in the Sacramento reinforced concrete tanks. This is the more striking when it is remembered that the periods of these steel tanks when full are about three times the periods when empty.

These results are logically explained by an examination of the facts: The ratio of weight of empty steel tanks to full steel tanks varies between 1 to 6 and 1 to 9. The water load is relatively more effective, during vibration, in the steel tanks, partly because the wall surface is great in comparison to the floor area and partly because of the relatively high amplitudes. In the concrete tanks, on the other hand, weight of tank empty to weight of tank full is in the ratio of 1 to 2.4 and the large flat bottoms and the relatively low side walls cause only a small proportion of the water to partake of the oscillating motion of the tank structure. Friction between floor and water is small and, similarly, the push of the sides upon the water is low.

This reasoning applies to normal vibrations under a light wind. Data on response of the water to vibrations forced by high wind or by earthquake are not available. However, it seems probable that a large mass of water still would be ineffective under the more violent disturbance because of the large floor surface. Moreover, since the structure is incapable of immediately setting in motion a large mass of water in response to its own motion, when once in motion the water would independently react and would tend to damp the vibration of the elevated structure. Also, the tank would respond appreciably to the slap of the water against the walls of the tank as water surged from side to side.

Vibration data on steel water towers were presented in detail in the *Bulletin* of the Seismological Society of America, January 1936, p. 69, and in special publication No. 201, U. S. Coast and Geodetic Survey, p. 75.



Standard Aerial Surveys

BAYONNE PORT TERMINAL COMPLETED

Said to be the largest shipping terminal of its kind in the world, this man-made island at Bayonne, N. J., in Upper New York Bay was finished the first of this month. It provides two miles of wharfage for ocean-going freighters. As the entire two miles will ultimately be served by rail lines for direct rail-ship transfer of goods, costly lighterage service will be eliminated.

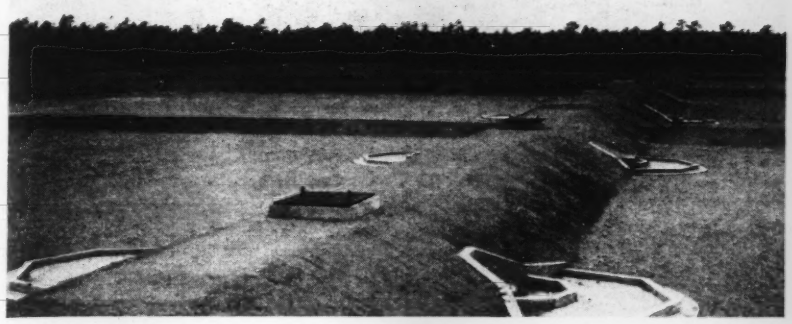


FIG. I. INTERMITTENT SAND FILTERS FOR SEWAGE TREATMENT AT HYANNIS, MASS.

Sewage Disposal in Sandy Soil

E. SHERMAN CHASE
Metcalf and Eddy, Consulting Engineers, Boston

Intermittent sand filters provide secondary treatment for sewage in a Cape Cod village

SOMEWHAT UNFASHIONABLE, but nevertheless effective and suitable is the method of treatment adopted for a recently constructed sewage disposal plant at Hyannis, Mass. Located at a site underlain by sandy soil, the plant provides preliminary sedimentation followed by intermittent sand filtration. The special conditions which led to the selection of this type of treatment were as follows:

Hyannis is in the southeastern part of the town of Barnstable, on Nantucket Sound and as a result of the popularity of Cape Cod as a summer resort, the population materially increases during the summer months. Furthermore, a state teachers college and a summer training school are located in the village. These activities bring about a concentration of population far in excess of that ordinarily found in a typical New England village.

The village is supplied with a public water system but until last year it had no sewer system. The waste water and sewage was, and to a considerable extent still is, disposed of in cesspools, septic tanks or similar individual systems. These methods of disposal in many instances have been found unsatisfactory and the cause of local nuisance. Particularly troublesome has been the disposal of sewage from schools, halls, stores and the more thickly settled portion of the village.

Before construction, no data were available as to the quantity of sewage produced in the village. Estimates, however, were made, based upon records of water consumption and the probable population tributary to the sewer system which was to be laid out. Inasmuch as the new sewer system was built on the separate plan it was assumed that the quantity of sewage produced per capita would approximate closely the water consumption. It was further assumed that the leakage into the sewers would be nominal in view of the sandy nature of the soil in which they were laid. As the basis of design, a sewage flow of 80 gallons per capita per day was assumed for normal conditions and 100 gallons per capita per day during the summer months of July and August.

The sewers were laid out to discharge to a small automatic pumping station from which the sewage is pumped to the treatment plant through about 1¾ miles of 10-in. cast iron force main. The pumping equipment consists of two electrically-operated, automatically-controlled, vertical shaft, non-clog centrifugal pumps. A standby internal combustion engine-driven generator is provided to permit station operation in case of outside power failure. The pumps are protected by a rack screen having clear openings of 1⅝ in. The quantity of sewage pumped is measured by a venturi meter with register-indicator-recorder.

In view of the recreational use of the shore waters and the presence of shell fish beds in the vicinity of Hyannis, it was decided that the discharge of untreated sewage into shore waters was obviously out of the question. Local conditions, particularly as regards the value of shore front

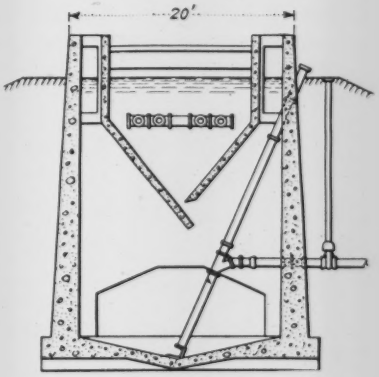


Fig. 2. Cross-section of the Imhoff tank.

property, indicated the desirability of locating the treatment plant back from the shore. Accordingly the town purchased some 136 acres of low value land north of the village and sufficiently remote as to render unlikely any interference with the growth of the community.

The soil at the site consists of a few inches of top soil and loam underlain by clean sand and gravel. Test pits were dug at several points and the samples of the material subjected to mechanical analyses. These disclosed that the material in place was suitable for sewage disposal processes. Conditions clearly indicated that the type of treatment to be adopted should consist of preliminary sedimentation followed by intermittent sand filtration.

For the preliminary treatment several considerations indicated the adoption of an Imhoff tank. A single Imhoff tank, 45 ft. long, and 20 ft. wide as shown on the accompanying sketch, was constructed. The sedimentation compartment of the tank is

designed to give a 2½-hr. detention period with an anticipated summer flow of 320,000 gal. per day. The sludge capacity is 3.42 cu. ft. per capita on the basis of the expected normal tributary population and 2.67 cu. ft. per capita for the expected summer population. Gas vents are continuous along each side of the tank and the freeboard provided is 4 ft. so as to allow considerable capacity for foam, should foaming occur. Provision is made for reversal of flow.

Two sludge beds are provided, each 25 by 50 ft. Sludge will be discharged to these beds by gravity. The drying bed area, 2,500 sq. ft., is equivalent to about one sq. ft. per capita of anticipated population.

Following the Imhoff tank is a dosing tank equipped with a 12-in. automatic siphon to provide for intermittent dosing of the filter beds. This tank is 33 ft. square and 6.75 ft. deep at the wall, inside dimensions, and has a dosing capacity of 40,000 gal. with a drawing depth of 5 ft. With one bed in use the number of doses, with the expected flows, will average five per day. One dose is equivalent to a depth of three in. over the entire area of one filter bed.

Eight units of sand filters were constructed by excavating the soil to grade and utilizing the excavated material to form the dikes surrounding the beds. Each bed is about 150 ft. square providing a total area of 4.2 acres. On the design basis, the loading per acre for 10 months will be about 600 persons, and for the summer will be 800 persons. The filter rate for 10 months will be 50,000 gal. per acre per day and for July and August, 80,000 gal.

In view of the extremely porous character of the soil, it was anticipated that there would be no effluent. Nevertheless it was decided as a factor of safety to put in three lines of 6-in. underdrains to each bed. These underdrains are located at a minimum depth of 3 ft. below the surface of the bed and are connected with a 12-in. drain, leading to a nearby depression from which the top soil had been stripped. The object of this arrangement was to provide some means of taking care of any excess water which might not be absorbed by the soil under the filters. So far no effluent has appeared and it is unlikely that such appearance will take place for many years.

Operating arrangements

The plant and pumping station have been so designed as to permit economical operation with the minimum of attendance. At the present time the superintendent of sewers, James S. Goff, a graduate civil engineer, comprises the entire permanent staff of the sewer department. Day labor is hired from time to time as work needs to be done on the filter beds or sewers. The estimated total operation cost of the sewer system, pumping station and treatment plant amounts to $3,450 for 19[illegible].

The cost of the completed disposal system was $94,848.

These figures do not include cost of land, legal, engineering or other administrative expense.

The contractor for the force main, as well as the sewers, was I. Capaldi & Sons, Inc., of Providence, R. I. Cenedella & Co. of Milford, Mass., built the pumping station and treatment works.

The work was carried out as a PWA project under the direction of the Board of Selectmen. Frederick T. Alden was resident engineer for Metcalf & Eddy.

Cutting Cofferdam Piles At Riverbed Level

DIFFICULTIES encountered in removing the steel sheet piling cofferdam around a bridge pier foundation at Hennepin, Ill., led the contractor, Wisconsin Bridge & Iron Co., to obtain permission to cut off the piles below river bed level and pull the top portion, using a diver and underwater torch to accomplish the cutting.

Fig. 1. Divers gear includes combined air and telephone lines in a single conduit. Under water the diver holds the torch by the head for close direction of the flame.

When driving the sheets for the Hennepin job a sloping stratum of rock or hardpan was struck which caused bending and distortion, possibly some splitting and curling. It was this condition which caused the pulling difficulties and ultimate resort to underwater cutting.

Arriving on the job at 7 a.m. the diver and two tenders assisted by the contractors crew had the diving and cutting gear set up and ready to operate at 11 a.m. After a few adjustments to compensate for local conditions the cutting operations proceeded at the rate of 22 to 29 sheets per 8-hr. day or 550 to 724 in. of actual cutting. As the sheets were cut a crane and extractor removed them singly rather than in sections, thus saving the time of the contractor in separating them above water. In six days 119 piles of standard I-27 sections, ⅜ in. thick with 25 in. of cutting surface were cut off. The last 7 sheets, a total of 175 in. of cutting, were cut off in 60 min. using 97.6 cu. ft. of acetylene and 280 cu. ft. of oxygen.

Adverse conditions prevailed. The diver worked inside the cofferdam at 23 to 27 ft. depths utilizing the walls as a protection against the heavy silt-laden flood waters passing at 1 ft. per sec. velocity. Instead of standing on a swung staging he worked on a soft uneven bottom in from 1 to 3 ft. of clay mud. About one-quarter of the cutting was done in a prone position so that the cut would be below the river bed. Visibility was nil 2 ft. below the water's surface and the diver had to regulate the cuts entirely by flame color shades. It was necessary to grasp the torch near the head which was sufficiently cooled by the water to permit handling but sparks cut through his leather gloves causing several burns.

As noted in Fig. 2 the surface setup consisted of a small 33x12-ft. diving scow which was arranged with multiply-connected oxygen and acetylene flasks as suggested by the diver in advance to hold the time charge to a minimum of $90 a day.

The late model diver's equipment was furnished with a newly devised two-way telephone enabling tender and diver to communicate regarding even small requirements. Air-lines and telephone cables are inclosed in a single conduit secured by chain to the diver's shoulder collar as shown in Fig. 1. In this picture is also shown the method of holding the torch by the head and the taped gas lines. This is an acetylene torch but a new one using hydrogen, which has a wider range in deep water, is being developed by the manufacturer, the Bastian Blessing Co.

On the diver's scow is a compact gasoline-driven air pump delivering 14 cu. ft. per min. instead of the usual hand pump which requires at least three pumpers.

With a good hoisting operator, gear and careful cooperative top-side crew to minimize potential diving hazards the diver was enabled to continue cutting while the previously cut sheet was being removed from its adjoining interlock.

The diver, Frank Hefling, Chicago, after this experience is of the opinion that the cutting of sheet piling, hitherto considered a costly procedure, will be used more often than in the past since enough has been done to make available accurate estimates of the time and cost.

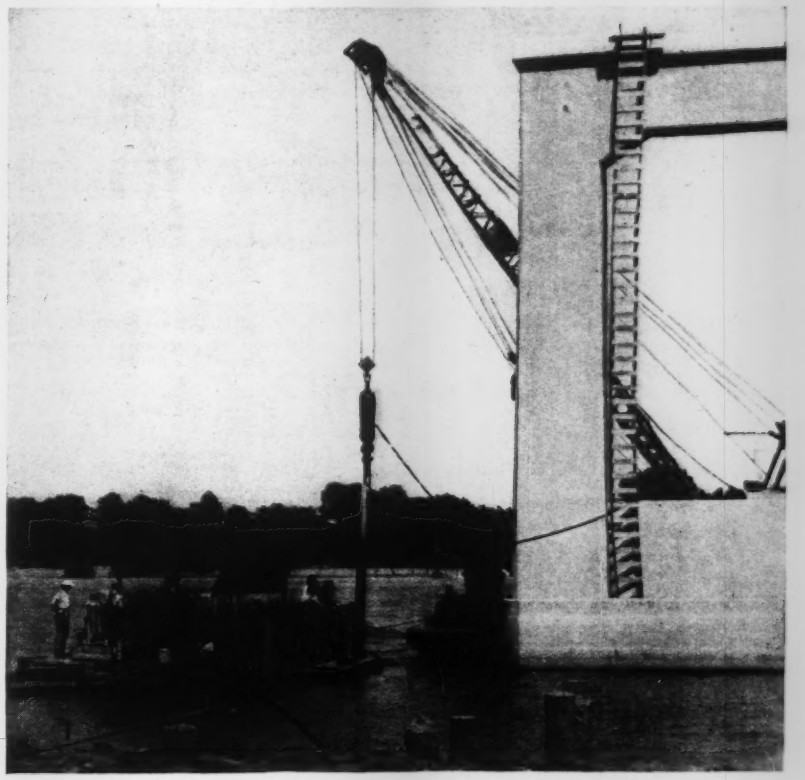


Fig. 2. Removing cofferdam piles after cutting by diver at river bed level. Divers scow is equipped with multiple-connected acetylene and oxygen flasks and a small gasoline driven air pump.

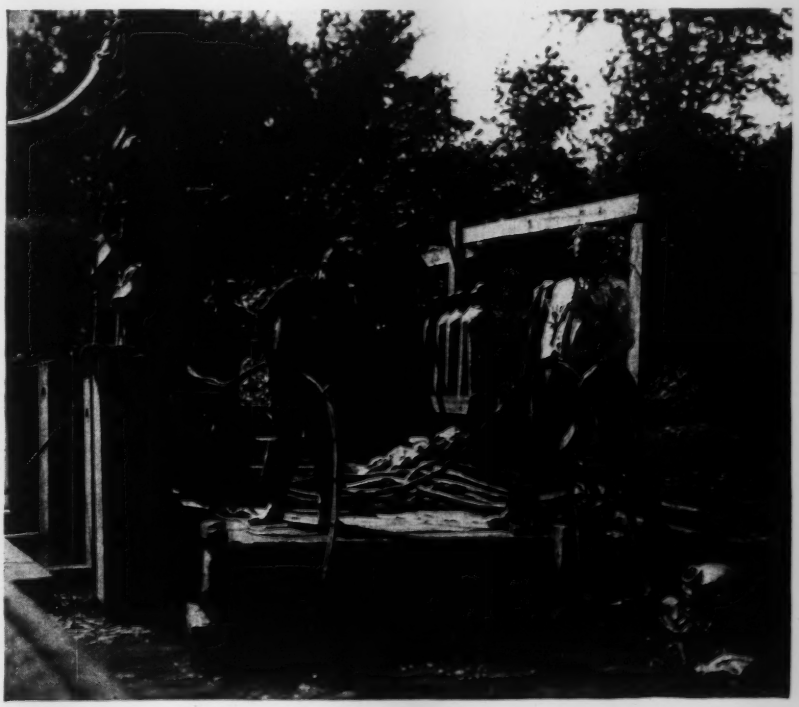


Fig. 3. The top-side crew is in constant communication with the diver, permitting continuous work. Scow is lashed to the piles, above which is the extracter.

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

OVERPASS, NEVADA

OWNER: Nevada State Department of Highways; Robert A. Allen, engineer.

PROJECT: Construction of a concrete and steel overpass and approaches, not including surfacing of approaches, 0.85 miles in East Ely, White Pine County, on Route 2. Contract time is 190 days and the site is served by the Nevada Northern Railway.

BIDS: Eight bids were received Nov. 3, 1938, ranging from the contract low of $79,203 to $90,118. Minimum labor rates are as follows: skilled, $1.00 per hr.; semi-skilled, 70c. per hr.; common, 62½c. per hr.

LOW BIDDERS:

1. Fredericksen & Westbrook, Sacramento (contract) $79,203
2. Nevada Rock & Sand Co., Inc., Reno..... 82,448
3. Silver State Construction Co., Fallon, Nev..... 83,385

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Roadway excav.	8,000 c. y.	$0.20	$0.25	$0.20
2. Borrow	126,834 c. y.	.16	.21	.19
3. Slope rounding	45 sta	13.00	5.00	5.00
4. Overhaul	656,742 y. sta.	.005	.01	.01
5. Overhaul	81,642 y. mi.	.16	.11	.15
6. Struct. excav.	440 c. y.	1.60	1.25	1.00
7. Backfill	470 c. y.	1.00	.60	1.00
8. Water	1,144 m. g.	1.60	1.50	2.00
9. Cl. 'A' conc.	209 c. y.	26.00	28.00	25.00
10. Cl. 'B' conc.	2 c. y.	39.00	30.00	30.00
11. Cl. 'D' conc.	195 c. y.	26.00	28.00	25.00
12. Reinf.	46,500 lb.	.08	.06	.08
13. Struct. steel	223,800 lb.	.08	.075	.07
14. Tr. timber piles	800 l. f.	1.00	.80	2.00
15. Drive timber piles	22 ea.	40.00	30.00	50.00
16. 18-in. corr. metal pipe (dipped)	52 l. f.	3.00	2.50	2.00
17. Monuments	8 ea.	3.00	4.00	5.00
18. Struct. steel railing	349 l. f.	6.50	4.25	5.00
19. Blast plate	1,030 s. f.	.65	1.00	1.00
20. Sidewalk filler	285 c. f.	1.30	2.00	1.00

CHANNEL IMPROVEMENTS, TEXAS

OWNER: International Boundary Commission, San Bentio; J. L. Lytle, engineer.

PROJECT: Arroyo Colorado channel improvements, Lower Rio Grande River flood control project in Hidalgo county, from El Fusto siphon to Drop Structure No. 1, straightening channel, excavating and making new embankments, siphons, etc. Labor rates are as follows: skilled, $1.00 per hr.; semi-skilled, 50c. per hr.; common, 35c. per hr.

BIDS: Six bids were received Sept. 30, 1938, ranging from the contract low of $172,800 to $280,660.

LOW BIDDERS:

1. R. W. Briggs & Co., Pharr, Texas (contract) $172,800
2. Russ Mitchell, Inc., Houston..... 194,525
3. H. B. Zachry Co., Laredo..... 195,700

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Clear, grub.	600 acre	$20.00	$35.00	$35.00
2. Clear., grub. "area B"	260 acre	10.00	35.00	20.00
3. Compact. embank., const. new east levee	530,000 c. y.	0.14	0.1325	0.15
4. Comp. embank., reconstr. exist. levees	600,000 c. y.	0.14	0.157	0.15

PAVEMENT COSTS, WINNIPEG

OWNER: City of Winnipeg, Man.; W. P. Brereton, city engineer.

PROJECT: The following table gives concrete street paving jobs in Winnipeg during 1938 and some of the unit costs which were entailed in their construction.

Type of Job	Area S. Y.	Cement Cost per S. Y.	Labor Cost per S. Y.	Other Materials per S. Y.	Grading S. Y.	Grading Cost per S. Y.
1. Lane (Alley)	1,465	$0.25	$0.45	$1.32	1,456	.43
2. Intersec.	101	.66	.51	1.44	.....	.....
3. Lane	2,303	.63	.33	1.27	2,203	.34
4. Lane	2,207	.67	.38	1.31	2,207	.57
5. 24-ft. St.	5,573	.68	.43	1.38	5,660	.37
6. 24-ft. St.	6,102	.74	.48	1.48	6,291	.25
7. 24-ft. St.	3,522	.75	.43	1.49	3,662	.25
8. Rounding curb	28	.69	1.10	1.20	.....	.....
9. 24-ft. St.	2,850	.76	.46	1.49	2,964	.30
10. 20-ft. St.	5,588	.75	.53	1.50	5,802	.23
11. 24-ft. St.	2,062	.46	.46	1.43	2,147	.25

GREAT RIVER BRIDGE WESTFIELD, MASS.

OWNER: City of Westfield, Mass., O. E. Parks, superintendent of public works.

PROJECT: Construction of new Great River Bridge over Westfield River, including removal of old bridge, constructing temporary bridge and new concrete and steel spans of 184 ft. length each. Roadway is 40 ft. and there are two 6-ft. sidewalks. Stipulated contract time is 266 calendar days. Transportation facilities by rail and highway are available. Existing pier and abutments are to be enlarged for the new bridge.

BIDS: Six bids were received Oct. 10, 1938, ranging from the contract low of $165,914 to $248,928. Minimum labor rates are as follows: skilled, $1.375 per hr.; semi-skilled, 60c. per hr.; common, 50c. per hr.

LOW BIDDERS:

1. Daniel O'Connell & Sons, Inc., Holyoke, Mass. (contract) $165,914
2. Frank T. Wescott, North Attleboro, Mass.... 188,942
3. Coleman Bros. Corp., Boston..... 189,957

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Temp. provi. for traffic	L.S.	$16,246.00	$35,000.00	$43,000.00
2. Remov. exist. bridge	L.S.	5,166.00	12,000.00	5,000.00
3. South abut	L.S.	8,864.00	11,000.00	13,000.00
4. North abut	L.S.	7,432.00	6,000.00	10,000.00
5. Pier	L.S.	8,175.00	7,000.00	18,000.00
6. Increased or decreased size of abutments and pier	50 c. y.	10.00	15.00	20.00
7. Grout holes	100 l. f.	1.00	1.00	1.00
8. Grouting-bags cem.	200 ea.	1.75	1.50	1.00
9. Carbon steel	900,000 lb.	.0598	.06	.055
10. Silicon steel	210,000 lb.	.0652	.06	.06
11. Bridge floor	L.S.	18,356.00	25,000.00	18,000.00
12. Pipes, conduits, lighting	L.S.	9,857.00	11,000.00	8,000.00
13. Approaches	L.S.	2,753.00	5,000.00	3,000.00
14. Establishment, preparation, cleaning up, etc	L.S.	12,770.00	1,000.00	800.00

(Contract Unit Prices continued on second following page)